Trapping and Coded-Wire Tagging of Wild Coho and Steelhead Juveniles from the Chemainus River System, 1977 and 1978

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March 1979

Fisheries & Marine Service Manuscript Report No. 1507

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Fisheries and Marine Service

Manuscript Report 1507

June 1979

TRAPPING AND CODED-WIRE TAGGING OF WILD COHO AND STEELHEAD JUVENILES FROM THE CHEMAINUS RIVER SYSTEM in 1977 and 1978

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ABSTRACT

Patterson, L.M., M.A. Erickson and V.C. deHrussoczy-Wirth. 1979. Trapping and coded-wire tagging of wild coho and steelhead juveniles from the Chemainus River system in 1977 and 1978. Fish. Mar. Serv. Man. Rep. 1507. 32 p.

Coded wire tagging of seaward migrant coho salmon (*Oncorhynchus kisutch)* and steelhead trout *(Salmo gairdneri)* smolts was carried out at three sites in the Chemainus River system, Vancouver Island, British Columbia, to provide information on the ocean migration and exploitation of these stocks. In 1977, 5720 coho smolts were tagged with code 2/3/5. In 1978, 15,969 coho smolts (codes 2/20/32 and 2/20/42) and 836 steelhead smolts (code 12/16/21) were tagged. Trapping sites and methods are described. Differences between streams in smolt production, size and migration timing are also discussed.

Key words: tagging, coded wire, coho salmon, steelhead trout, smolt, juvenile, migration, British Columbia.

RÉSUMÉ

À trois endroits du systeme de la riviere Chemainus, dans l'Île Vancouver (Colombie-Britanique), on a procédé a l'aide de fil code, en marquage de saumons coho *(Oncorhynchus kisutch)* et de truites arc-en-ciel *(Salmo gairdneri)* émigrant vers la mer, afin de recueillir des données concernant la migration dans l'ocean et l'exploitation des stocks. En 1977, 5720 saumoneaux coho ont été marqués du code 2/3/5. En 1978, 15969 saumoneaux coho (codes 2/20/32 et 2/20/42) et 836 saumoneaux arc-en-ciel (code 12/16/21) ont subi le marquage. Le texte décrit les endroits et les methodes de capture. Il traite également des productions, des tailles et des periodes de migration des saumoneaux, aspects qui diffèrent selon les cours d'eau.

Mots-clés: marquage, fil codé, saumon coho, truite arc-en-ciel, saumoneau, juvenile, migration, Colombie-Britanique.

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INTRODUCTION

Coded wire tagging of wild chinook *(Oncorhynchus tshawytscha)* and coho *(O. kisutch)* salmon juveniles has been carried out by the Fisheries and Marine Service since 1974. The program was designed to provide information on the ocean migration and exploitation of selected southern British Columbia chinook and coho stocks through tag returns from the various fisheries. Such data are essential to fishery management and to the planning and evaluation of the Salmonid Enhancement Program. Reports have been published on the initial tagging projects conducted on the Squamish (Argue and Armstrong, 1977) and the Cowichan (Armstrong and Argue, 1977) river systems.

This report presents the results of the juvenile salmon tagging project in the Chemainus River area in 1977 and 1978. Though the principal objective of the project was to tag seaward migrating coho salmon smolts, steelhead trout *(Salmo gairdneri)* smolts were also tagged. The project provided incidental information on the magnitude and timing of salmonid migrations, as well as data on size and age of migrants.

LOCATION AND DESCRIPTION OF TRAPPING SITES

The Chemainus River drains a 378 km^2 area of southern Vancouver Island (Fig. 1). The river, which is approximately 52 km long, flows in an easterly direction to enter Stuart Channel just south of the community of Chemainus. Mean annual discharge of the river, based on 29 years of record, is estimated at 19.2m^3/sec (679 cfs). Recorded extremes of discharge are 0.07 m^3/sec (2.5 cfs) and 456 m^3/sec (16,100 cfs) (Inland Waters Directorate, 1977). The upstream migration of chinook and coho salmon spawners is restricted to the lower 13 km of river by a falls at Copper Canyon (Marshall et al, 1976).

Smolt trapping was carried out at three sites: (i) in the main Chemainus River near the mouth; (ii) in Miller Creek, a Chemainus River tributary, and (iii) in Bonsall Creek, which flows into Stuart Channel about 4 km south of the Chemainus River (Fig. 2). In 1977, only a side channel of the Chemainus River was trapped, whereas, in 1978 the entire width of the Chemainus was trapped in an effort to capture larger numbers of smolts for tagging.

CHEMAINUS RIVER

The Chemainus River averages approximately 35 m wide in the lower 6 km (Fraser et al. 1974). Bank vegetation is comprised of maple, alder and cottonwood trees, interspersed with fir, cedar and spruce. Due to its width, most of the river is unshaded. In the area of the trap site a gravel bottom prevails.

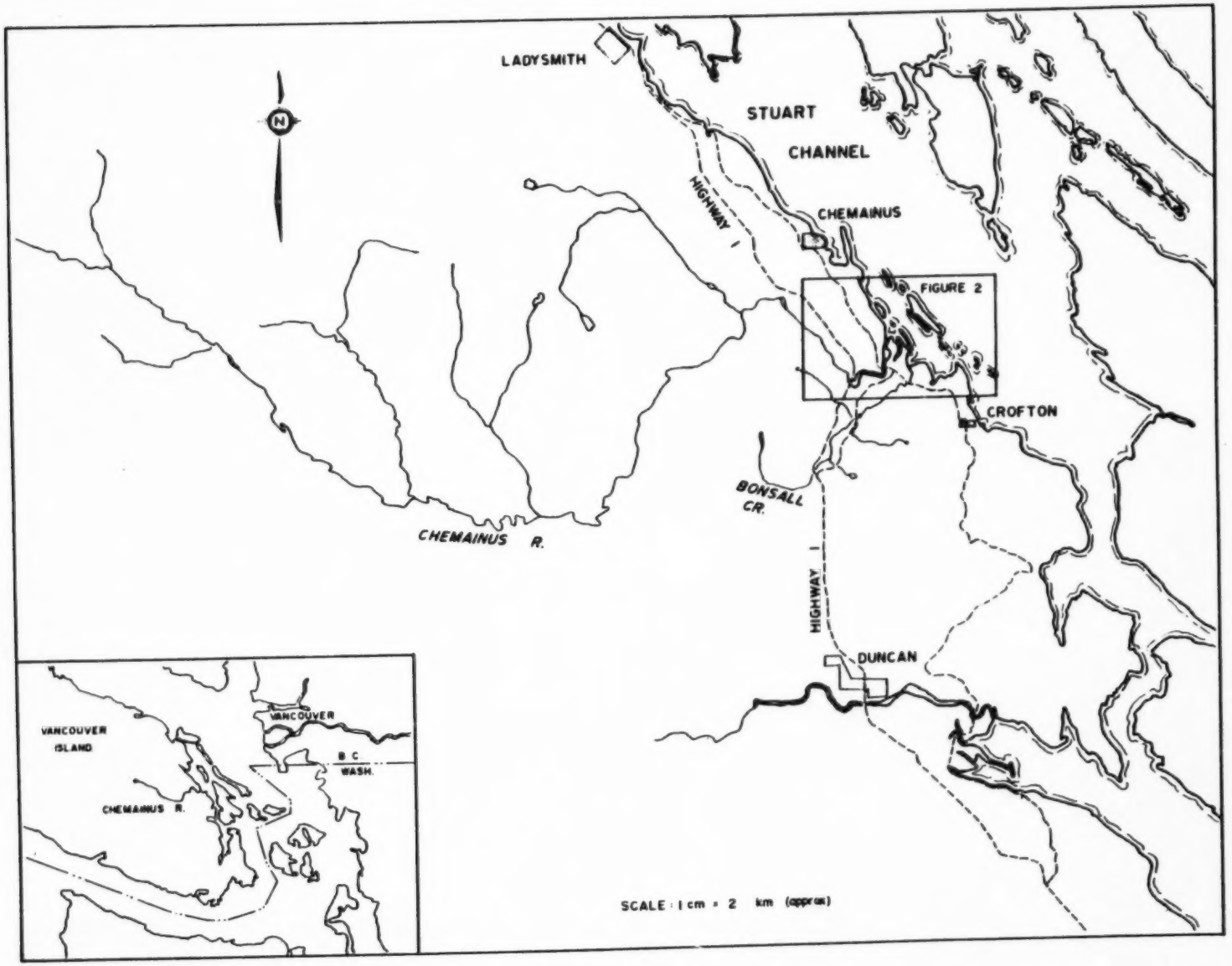

FIGURE 1. Map of Chemainus River system, showing location of study area.

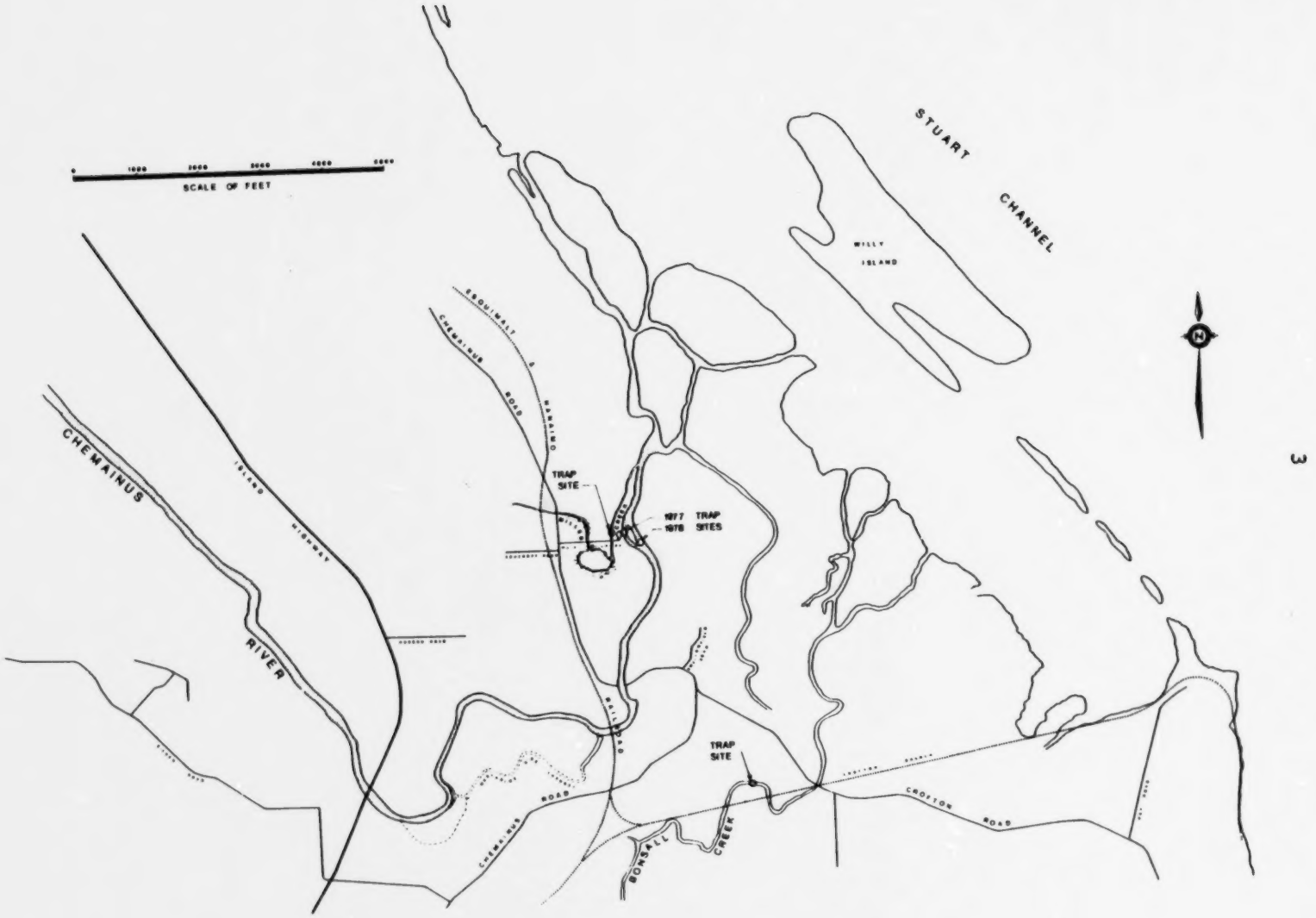

FIGURE 2. Chemainus River area smolt trapping sites in 1977 and 1978.

In 1977, a fence trap was installed in a 200 m long side channel on the left bank of the river upstream of Miller Creek (Fig. 3). The downstream end of this channel is just above tidal influence. The 1978 trap was located in the main channel, at the upstream end of the side channel trapped in 1977. The fence was installed in a "W" form (Fig. 4), to increase water screening capacity and thus minimize debris buildup and stress of juvenile migrants in the live boxes.

MILLER CREEK

Miller Creek flows into the Chemainus River near the head of tidal influence, about 50 m downstream of the Chemainus River side channel (Fig. 5). It is a small creek, approximately 700 m long (excluding the bog) and 1 - 1.5 m wide during spring. The creek drains a 1.5 hectare bog area on the Hols' and adjacent properties. The property owners had partially filled the bog with wood chips prior to the spring of 1977. The water level in the bog and its outflow are controlled by a beaver dam. The bog is fed by a 300 m long creek which drains the slope on the west side of Westholme Road. Flows in this upper section are minimal in spring and non-existent in summer, but the creek occasionally overflows its banks in the late fall and winter.

The fence trap installation was 200 m upstream of the confluence of Miller Creek and the Chemainus River (Fig. 6). To ensure adequate water flow through the trap, the beaver dam at the bog outlet had to be breached frequently.

BONSALL CREEK

Bonsall Creek originates west of the Island Highway and flows northeast to enter Stuart Channel just south of the Chemainus River (Fig. 1). In spring it is 5 - 7.5 m wide and 7.5 km long. In the fall, salmon spawners have access to the lower 8 km of stream (Fraser et al. 1974).

There are three main tributaries to Bonsall Creek. The lowermost tributary, Whitehouse Creek, enters Bonsall Creek on the north side approximately 3.6 km upstream from tidewater. This stream has an overall length of 2.6 km. Eves Creek, a very small stream, joins Bonsall Creek 1 km upstream from Whitehouse Creek. The third tributary, Solly Creek, runs west from Solly Lake for 1.1 km before entering Bonsall Creek 1.2 km upstream from Eves Creek. Coho salmon have been observed to utilize Solly Lake for rearing.

Bonsall Creek flows mainly through farmland. The stream bottom, which is a mixture of mud and gravel, supports aquatic weed growth. Though portions of the creek are exposed, with thistle-covered, grassy banks, most of the creek is shaded by cottonwoods and alders.

FIGURE 3. Chemainus River side channel fence trap used in 1977.

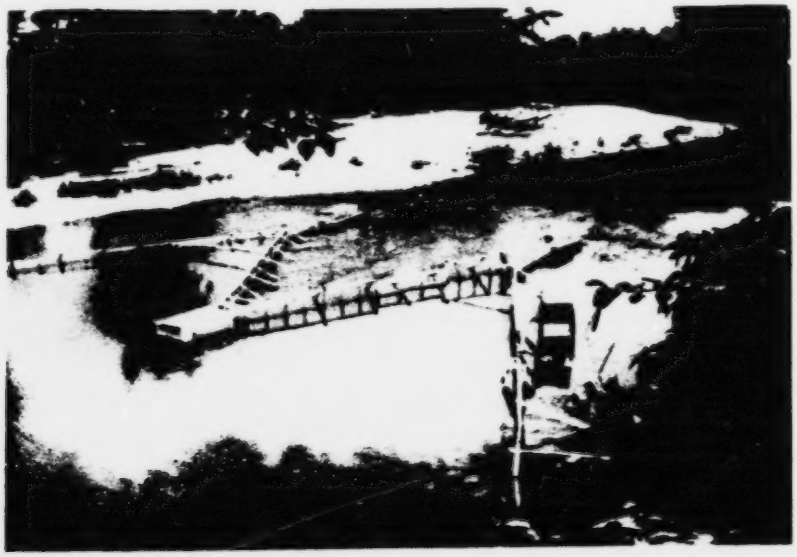

FIGURE 4. Chemainus River "W" fence trap installed in the main river channel in 1978. Centre trap on left of the photograph was used for upstream migrating adult steelhead. The side channel shown in Figure 3 flows around the far side of the gravel bar.

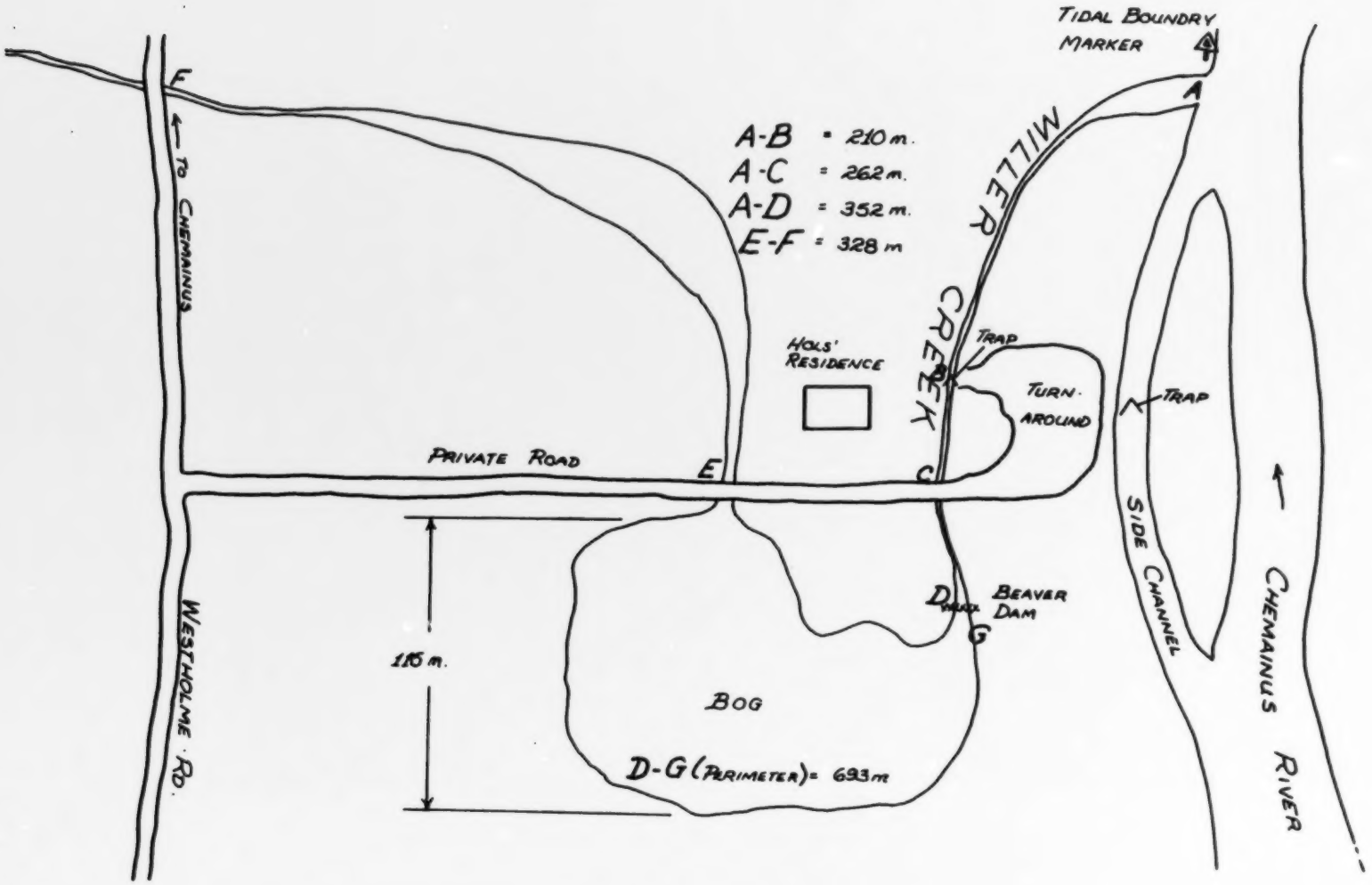

FIGURE 5. A sketch map of Miller Creek, showing trap location.

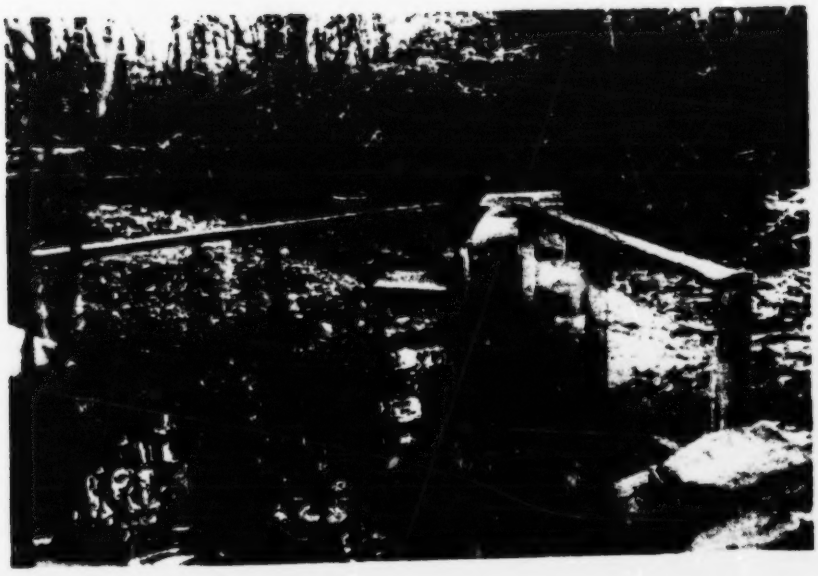

FIGURE 6. The Miller Creek fence trap (upper) and beaver dam (lower).

The fence trap was installed in a pool and riffle 60 m upstream from the Crofton road (Fig. 7). This site was chosen because it was accessible by road. During extreme high tides some backwatering of the fence occurred.

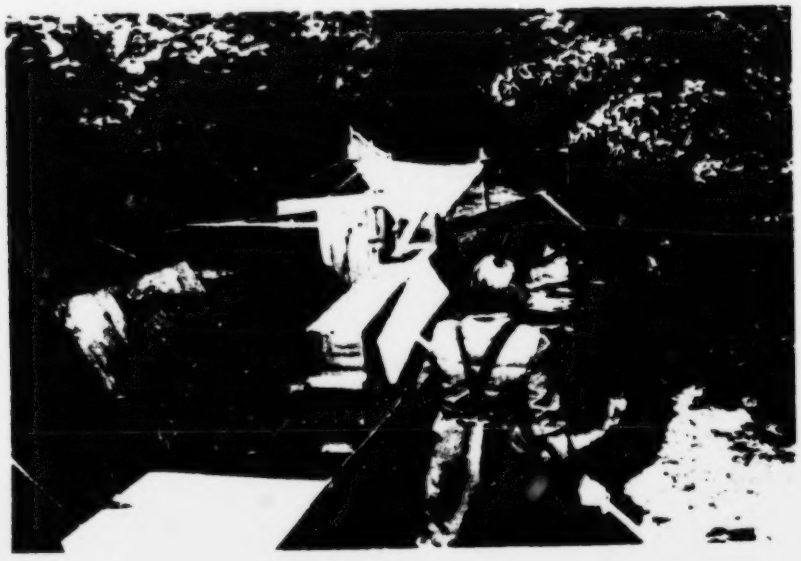

FIGURE 7. Bonsall Creek fence trap installed in 1978.

METHODS

CAPTURE OF JUVENILES

Fence Trapping

Fence traps (Fig. 8) were installed and operated at Bonsall and Miller creeks and at the Chemainus side channel in 1977 according to the procedures described by Armstrong and Argue (1977). In 1978, a modified trap with a "W" shape and two downstream live boxes was installed in the main channel of the Chemainus River (Fig. 9). The adjacent side channel on the left bank was blocked with one lead. Hinged gates were placed in the leads to enable release of excessive water pressure under high flow conditions (Fig. 10). The stream bottom along the "W" fence was lined with heavy plastic to prevent undermining. Trap live boxes were four feet high, rather than the three foot height used at the other sites, in order to accommodate the greater fluctuations in water level.

In 1977, traps were installed at Miller Creek during April 23 - May 30, and at the Chemainus River side channel during May 7 - 29. Trapping was

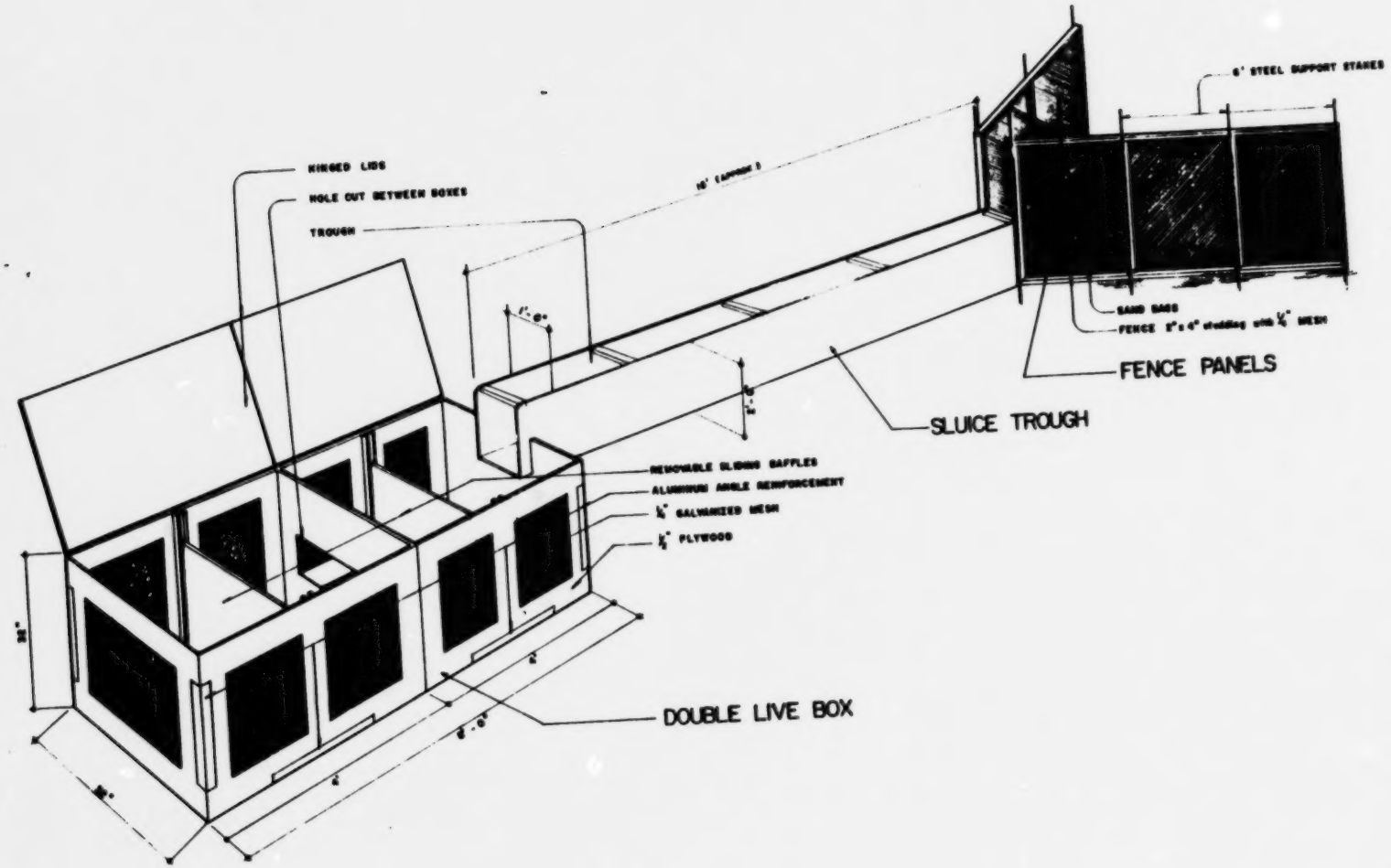

FIGURE 8. Fence trap design used at Bonsall and Miller creeks.

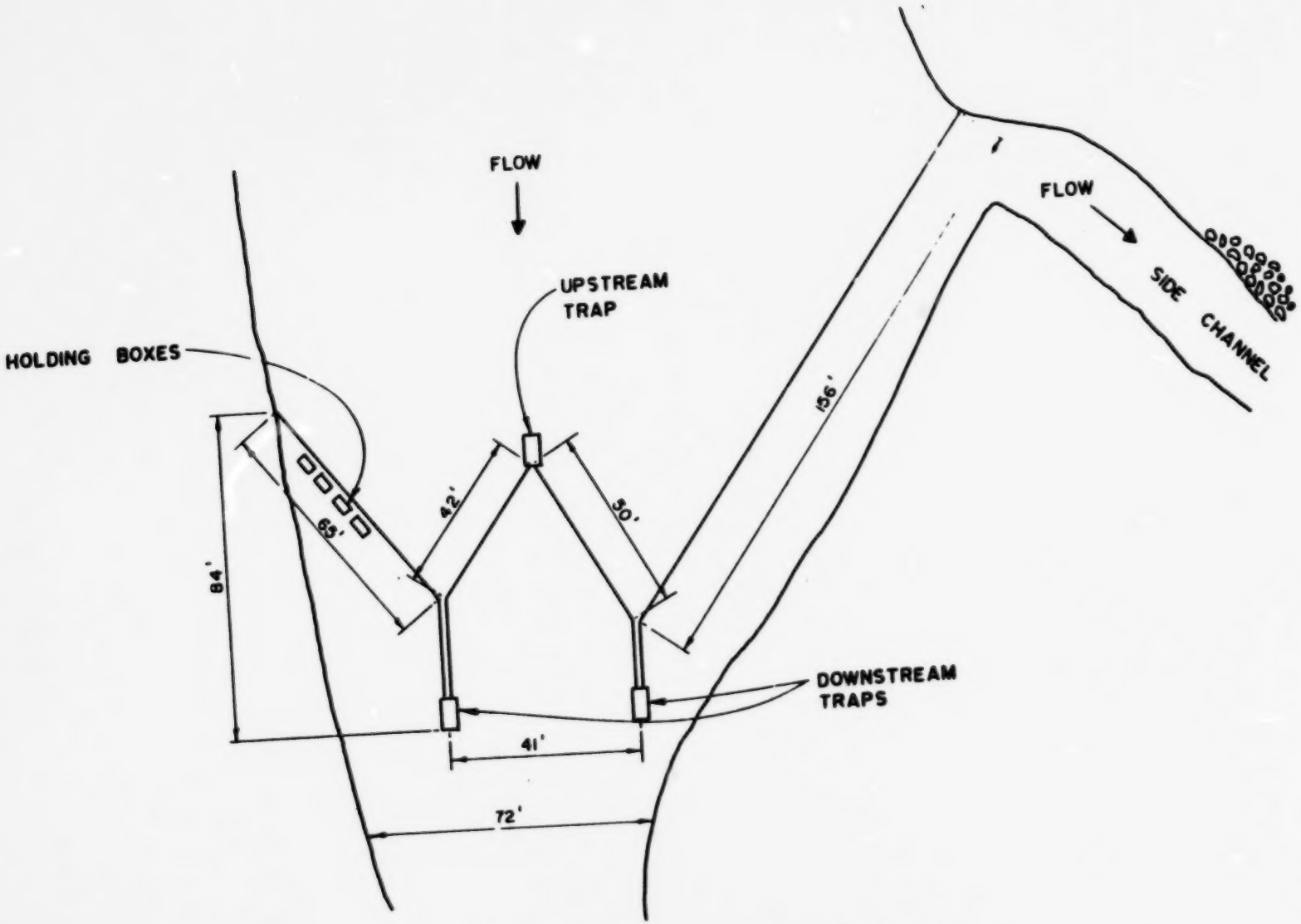

FIGURE 9. Diagram of the Chemainus River "W" fence trap installed in 1978.

FIGURE 10. Hinged gates for relieving pressure on the Chemainus River "W" fence trap, closed (above) and open (below).

also conducted for five days (April 28 - May 2) at Bonsall Creek, to determine the availability and abundance of smolts in that stream. In 1978, trapping at all three sites started during the April 11 - 17 period and was terminated at various times in June, depending on the site (Appendices A - C).

Catches were removed from all traps and counted daily, generally during the morning.

Traps for upstream migrating fish were installed at the Chemainus and Bonsall Creek sites in 1978 to enable capture and release of adult steelhead and cutthroat trout *(Salmo clarki clarki)* above the fences (Fig. 4).

Minnow Trapping

In April and May 1977, minnow traps baited with salmon roe were used in the main Chemainus River, in the Westholme Channel (Fig. 11), and in Miller Creek bog to aid in selecting the best trapping sites and to provide additional coho smolts for tagging (Appendix G).

Trap Efficiency

All fence traps were checked daily in an attempt to ensure that they were fish-tight. No tests of trap efficiency were conducted in 1977. In 1978 single trap efficiency tests were conducted with coho smolts at both Bonsall Creek and Chemainus River. Marked coho smolts were released approximately 199 m upstream of each trap site. All released fish had been injected with coded wire tags (CWT) and marked by removal of the adipose fin and either the upper or lower lobe of the caudal fin.

In the Bonsall Creek test, 71% of the marked coho smolts were recaptured, most within 10 days of release (Table 1). However, the trap efficiency test at Chemainus River was rendered invalid due to the high discharge which interrupted trap operation during May 13 - 15 (Figs. 12 and 13).

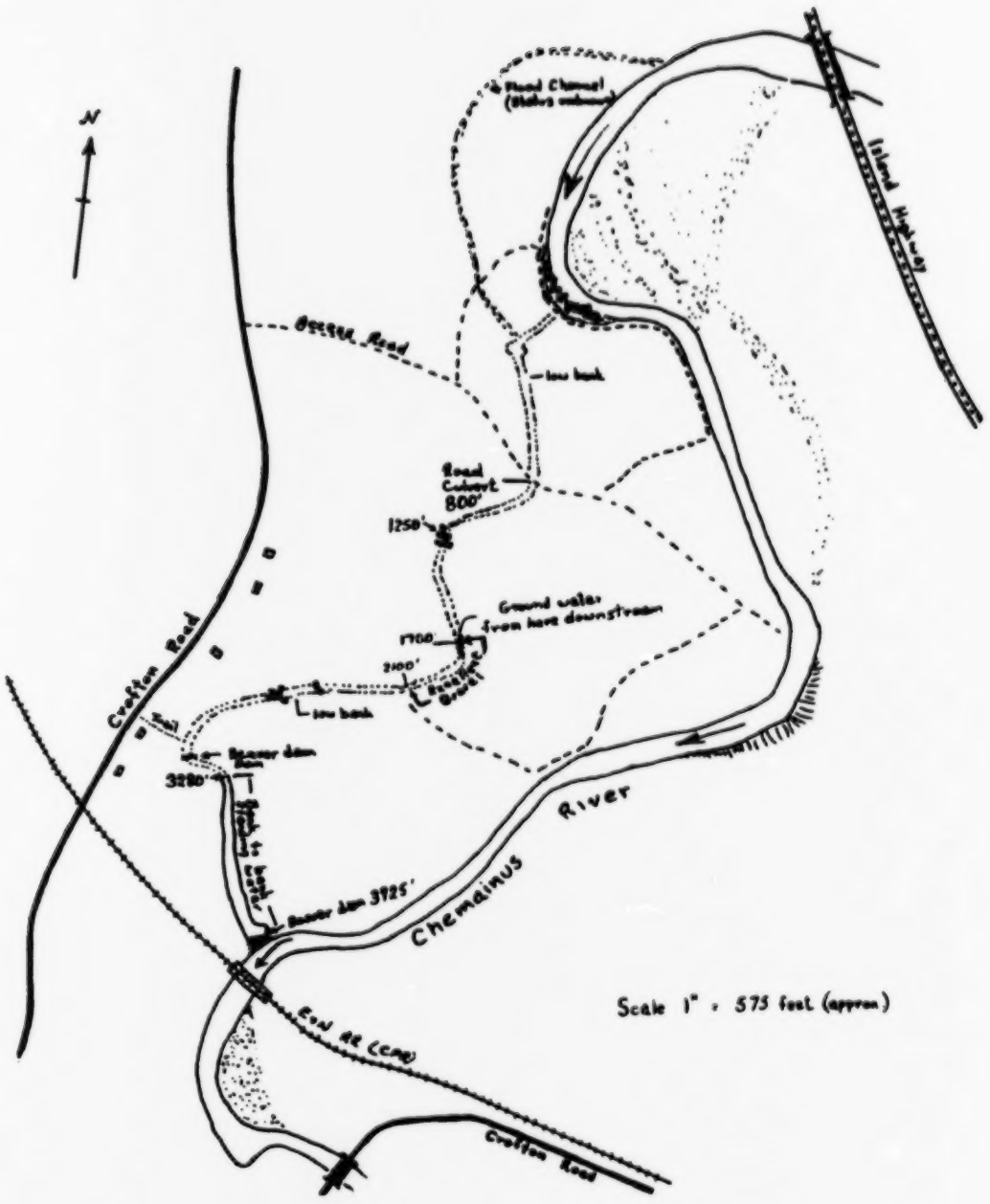

FIGURE 11. Sketch diagram of the Westholme Channel, a side channel of the Chemainus River, where minnow traps were set for coho smolts.

FIGURE 12. The Chemainus River fence trap under high flow conditions in May, 1978.

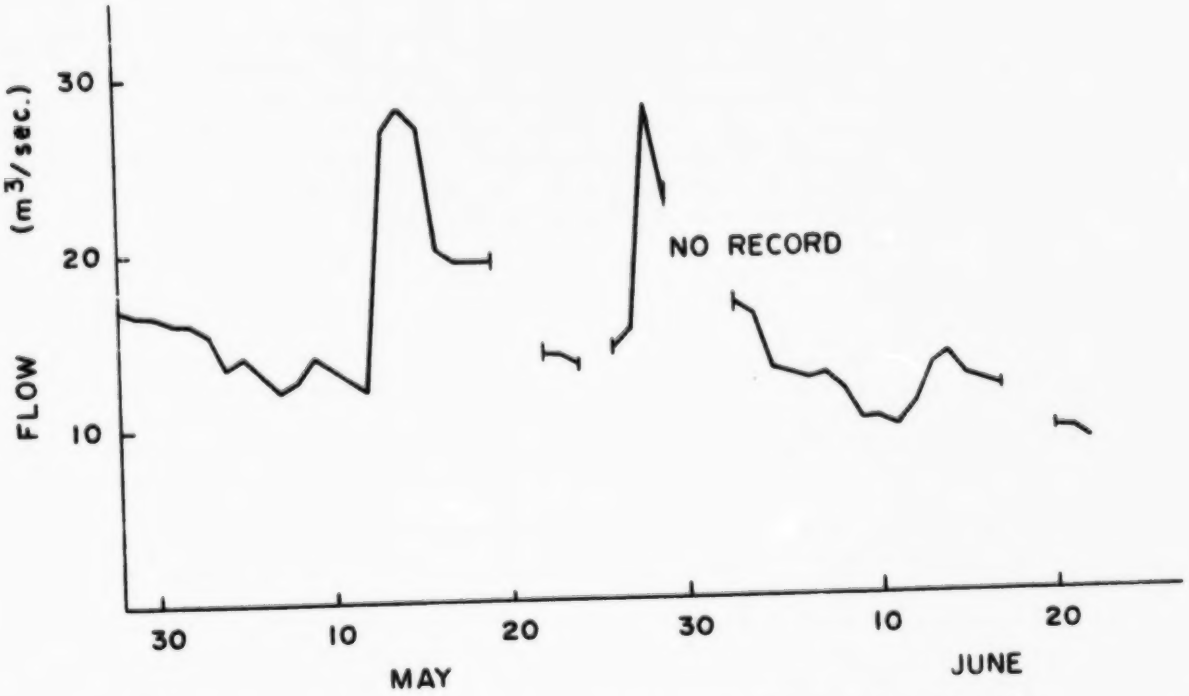

FIGURE 13. Discharge of the Chemainus River near the mouth during the 1978 trapping program, as measured by the project staff.

TABLE 1. Results of coho trap efficiency test at Bonsall Creek in 1978. Caudal (lower lobe) - adipose fin clip combination was used.

DATE	NO. RELEASED	NO. RECOVERED
May 25	100	3
28	-	36
June 1	-	8
5	-	18
11	-	3
12	-	1
19	-	1
	TOTAL	71

BIOLOGICAL SAMPLES

Scale samples and measures of fork length (to nearest mm) and wet weight (to nearest 0.1 g) were taken from samples of tagged coho smolts in 1977. Miller Creek and Chemainus River coho smolt samples were combined in 1977. Bonsall Creek coho smolts were not sampled in 1977.

In 1978, a sample of coho smolts from each tagging lot was held overnight prior to measurements and scale sampling. Separate samples were taken from Miller Creek and Bonsall Creek tag lots. Steelhead smolts from Miller Creek and Chemainus River were also sampled. To ensure a random sample, subsamples of 10 - 15 fish were periodically removed from the container at the Quality Control Device (QCD) outlet throughout the tagging operation until a total sample of approximately 200 fish was obtained.

TAGGING

The coded-wire smolt tagging operation closely followed that described by Armstrong and Argue (1977). Except for samples retained for size measurements, the fish in each tagged lot were released 1/2 hour to 2 hours after tagging was completed.

Daily catches of coho smolts were held for an average of 7 days (range of 2 - 11 days) before the accumulated catch was tagged. Smolt mortality during the holding period and immediately following tagging was relatively low, amounting to 5% at Miller Creek in 1977 and 1978, and less than 1% at Bonsall Creek in 1978 (Appendices A - F).

TAG LOSS CHECKS

The majority of tagged lots were sampled to determine the magnitude of immediate or short-term tag loss. This was accomplished by anaesthetizing a sample of tagged fish and passing them through the QCD several hours after tagging. In 1977, 818 (14 %) of the tagged coho smolts were tested within 1 - 11 hours of tagging. In 1978, all samples of tagged smolts were held for 24 hours before testing. The coho smolt samples totalled 1999, 12 % of the number tagged. A total of 161 steelhead smolts were also examined for tag loss (Appendices H and I).

TAG CODES

Tag codes are given in the following order: Agency/Data 1/Data 2. In 1977, all coho smolts were tagged with one tag code (2/3/5). This tag lot included fish captured at Miller Creek, at the Chemainus River side channel, and in minnow traps.

In 1978, a distinctive tag code was used for each capture location. The tag codes for coho smolts were assigned as follows: Miller Creek (2/20/32), and Bonsall Creek (2/20/42). A single tag code (12/16/21) was used for steelhead smolts captured in the Chemainus River and in Miller Creek.

OBSERVATIONS AND DISCUSSION

NUMBERS CAUGHT AND TAGGED

Coho Salmon

In 1977, 6172 coho smolts were captured at the Miller Creek and Chemainus side channel trapping sites, as well as by minnow traps.[1]

Of these, 5693 coho smolts were released with coded wire tags (Table 2). At Bonsall Creek 525 coho smolts were captured, but were released untagged when the fence trap was removed on May 2, 1977 (Appendix C).

[1]Counts of daily coho smolt catches at each trap site were made quickly to reduce handling time. There are therefore differences between the totals of daily catches in Appendices A - F and the "Total Catch" in Table 2, which is the sum of "Marked and Tagged", "Mortality", and releases of untagged smolts from Appendices H and I.

TABLE 2. Coho salmon and steelhead trout smolt marking and tagging data, Chemainus River study area, 1977 and 1978.

	Tagging Location	Capture Timing	Total Catch[b]	No. Marked and Tagged	Corrected Release[c] Marks Without Tags	Corrected Release[c] Tags	Wire Tag Code Agency/D1/D2
		1977					
Coho	Miller Creek/ Chemainus side channel[a]	Apr.23-May 30	6172	5805	85	5720	2/3/5
		1978					
Coho	Miller Creek	Apr.11-June 3	5564	5297	48	5249	2/20/32
	Bonsall Creek	Apr.13-June 19	10932	10839	119	10720	2/20/42
Steelhead	Miller Creek	Apr.11-May 23	99	94	1	93	12/16/21
	Chemainus River	Apr.18-June 15	787	751	8	743	12/16/21
		May 1	3	3	0	3	2/20/32

[a] includes minnow-trapped smolts

[b] includes "marked and tagged" from Appendices H and I + unmarked releases + mortalities

[c] corrected for preliberation tag loss.

In 1978, 16,496 coho smolts were captured at Miller Creek and Bonsall Creek, and an estimated 15,970 smolts were released with coded wire tags. The numbers of tagged fish released from Miller Creek and Bonsall Creek totalled 5260 and 10,710 respectively (Table 2). As only 55 coho smolts were captured in the Chemainus River trap, all were released untagged (Appendix A).

Records of fry catches were incomplete in 1977. Approximately 1500 coho fry were captured at the three trap sites in 1978: 300 at Miller Creek, 500 at Bonsall Creek, and 700 at Chemainus River. The majority of fry were captured between the last week of May and the third week of June. It should be noted, however, that the above catches do not likely represent the total fry migration at each site, as fence mesh sizes were too large to ensure capture of all fry.

The upstream trap in the Chemainus fence also captured 815 coho fry in 1978.

Steelhead Trout

Steelhead smolt catches were not recorded in 1977. The three trapping sites yielded 940 steelhead smolts in 1978, with the majority (87 %) being caught in the Chemainus River. Releases of tagged steelhead smolts from Miller Creek and Chemainus River totalled 97 and 747 respectively (Table 2). The 29 steelhead smolts captured at Bonsall Creek in 1978 were released untagged.

In May and June, 1978, 64 adult steelhead and 910 juvenile steelhead were captured in the Chemainus fence upstream trap and released above the fence (Appendix J).

Chum Salmon

Approximately 9800 chum salmon *(Oncorhynchus keta)* fry were captured in the fence traps, including totals of 1800 and 8000 in Bonsall Creek and Chemainus River respectively. At Bonsall Creek, where the trap remained operative throughout the migration period, the peak migration of chum fry in 1978 occurred between May 10 and June 3. As noted above for coho fry, the screen mesh size on the traps permitted only a partial count of the chum fry emigration.

Chinook Salmon

Chinook salmon *(O. tshawytscha)* fry migrants were taken only in the Chemainus River. The 1978 catch of this species totalled 51 fish, the majority of which were taken during the period late May to mid-June.

Other Species

Sculpins and sticklebacks were captured at all fence traps. Lamprey were taken in the Chemainus River and Bonsall Creek traps, but not at Miller Creek. At Bonsall Creek, where the trap was within the influence of exceptionally high tides, 6 flounders were also captured. These non-salmonid fishes were not identified with respect to species.

PRELIBERATION TAG LOSS

The results of individual checks for short-term tag loss are presented in Appendices H and I.

Coho Smolts

Checks of tagged coho smolts provided the following measures of tag loss:

Year	Site	No. of Checks	No. of Fish Examined	Tag Loss (%)	
				Overall Average	Range
1977	Miller Ck. - Chemainus R.	4	818	1.5	0 - 3.0
1978	Miller Ck.	5	776	0.9	0 - 2.3
1978	Bonsall Ck.	8	1223	1.1	0 - 3.3

Steelhead Smolts

Short-term tag loss from steelhead smolts taken in the Chemainus River Trap in 1978 was estimated at 1.0 %. The incidence of tag loss in three checks ranged from 0 to 1.5 % (Appendix I). Tag loss was not checked at Miller Creek in 1978, due to the small number of steelhead smolts tagged at that site.

NATURALLY MISSING ADIPOSE FINS

At each tagging site coho salmon smolts were carefully examined to document the incidence of naturally missing adipose fins. Including all sites and both years of study, only 1 smolt in 1291 had a naturally missing adipose fin (Table 3). This result is similar to the 1 in 1311 incidence of naturally - missing adipose fins observed among coho smolts in the Squamish River system (Argue and Armstrong, 1977), and the 1 in 1396 incidence among Cowichan River coho smolts (Argue et al., 1979).

TABLE 3. Incidence of coho smolts with naturally missing adipose fins at each tagging site in the Chemainus study area.

Year	Tagging Site	Examined	Adipose Missing		
			No.	%	Incidence
1977	Miller Creek/Chemainus side channel	5805	8	0.13	1/726
1978	Miller Creek	5297	4	0.08	1/1324
	Bonsall Creek	10839	5	0.05	1/2168
Total		21941	17	0.08	1/1291

It is considered that this low incidence of naturally missing adipose fins would not measurably affect the assessment of either tag loss or tagged : untagged ratios in the adult returns to these streams.

COHO SMOLT OUTPUTS

The 1978 trapping at Miller and Bonsall creeks provided the only data sufficiently complete to enable reliable comparisons of smolt output relative to stream length and area. Point estimates of the 1978 smolt output from the two streams are as follows:

	Smolt Output
Miller Creek	5369
Bonsall Creek	15820

It should be noted that the Miller Creek figure is a minimum estimate, as it assumes that the total migration was intercepted, whereas the Bonsall Creek estimate is based on the efficiency rating (71 %) obtained from a marked fish release. Ninety-five percent confidence limits for the Bonsall Creek estimate are 14,219 and 18,414 smolts (Adams, 1951).

A comparison of coho smolt output from these two streams in relation to their area and length is presented in Table 4. In the case of Miller Creek, the bog area and its shoreline were included in the respective measures of stream area and length. The length and area measures for Bonsall Creek include only the accessible stream sections.

TABLE 4. Smolt outputs from Bonsall and Miller creeks in 1978 on a stream length and area basis.

	Accessible		Output per Area		Output per Length	
	Area (m^2)	Length (km)	No./100m^2	kg/100m^2	No./km	kg/km
Miller Creek	17,125	1.4	31.4	0.42	3919	52
Bonsall Creek	56,125	11.2	28.2	0.46	1413	23

Though output per unit area from the two streams was similar, output in number and weight per unit length was 2 - 3 times greater in Miller Creek. The relatively high output per unit length from Miller Creek may have been due to its bog area, which would likely have a greater carrying capacity than an equivalent length of stream. On the other hand, the length statistic given for Bonsall Creek may overstate rearing capability, as it may include sections not utilized for rearing during the low flow period. A third possibility is that Miller Creek functions to some extent as an overwintering area for coho juveniles which had reared elsewhere in the Chemainus system during the previous summer.

High discharge conditions in the main Chemainus River during mid-May of 1978 prevented development of a coho smolt population estimate for that trapping site. However, the very low seasonal catch of coho smolts in the Chemainus relative to Miller Creek (53 vs 5369) indicates that the latter stream is the principal area of coho smolt production in the Chemainus system.

The smolt output per stream length from Bonsall Creek is similar to that reported for Pastuch Creek (1248/km) on the Cowichan River system (Armstrong and Argue, 1977) and for two Squamish area streams, the Little Stawamus River (1800/km) and Meighn Creek (1322/km) (Argue and Armstrong, 1977). However, Bonsall Creek's production is significantly lower than that observed in a side channel of the Cowichan River (3809/km) and in Tenderfoot Creek on the Squamish system (12,209/km). These latter areas may have more in common with Miller Creek. Tenderfoot Creek has a lake at its head which rears coho (Argue and Armstrong, 1977) and the Cowichan side channel is considered to be a likely overwintering area for coho juveniles (Armstrong and Argue, 1977).

On the basis of output per area, Bonsall and Miller creeks produced fewer smolts than the Cowichan and Squamish streams, where smolt output ranged from 41 to 141/100 m^2. However, their smolt production per area was still approximately twice the 18/100m^2 rate observed at Big Qualicum River (Lister and Walker, 1966).

MIGRATION TIMING

Coho Smolts

In 1978, coho smolts had begun migrating from study streams in small numbers by the time of trap installation during mid-April. Their migration peaked in May and, in the case of Bonsall Creek, continued until late June. Coho smolts migrated from Miller Creek two weeks earlier than from Bonsall Creek (Table 5). The 1978 migration from Miller Creek was comparable in timing to the 1977 migration, with the peak 50% taking place in the first two weeks of May. The numbers of smolts captured in the Chemainus River traps were too low to accurately reflect migration timing in that stream.

TABLE 5. Coho smolt migration timing at Miller and Bonsall creeks.

Trap Site		Days Fished	Date of 50% Migration	Peak 50% of Migration	
				Period	Duration (Days)
Miller Creek	1977	38	May 6	Apr.29-May 13	15
	1978	55	May 9	May 3-May 13	11
Bonsall Creek	1978	68	May 23	May 13-May 31	19

The earlier timing of migration in Miller Creek may have been due to higher temperatures (Fig. 14). Water temperatures in Miller Creek rose more rapidly and were generally 1 - 2° C higher than in Bonsall Creek during April and May of 1978. Another significant factor may have been the flow in Miller Creek, which declined rapidly in late May to virtually no flow by June 1. As this is undoubtedly an annual occurrence, the Miller Creek coho population may have developed behavior patterns, ie. earlier smolt migration timing, conducive to successful emigration while stream flows permit.

Differences in coho smolt migration timing from tributaries of the nearby Cowichan River have also been noted, but no clear relationship could be established between stream temperature and time of migration in that river system (Armstrong and Argue, 1977).

Steelhead Smolts

The 1978 Chemainus River trap operation was the only one which captured significant numbers of steelhead smolts. It was apparent from this operation that most of the steelhead smolt migration took place during May.

AGE AND SIZE OF MIGRANTS

Coho Smolts

Age 1. coho smolts, which had spent one winter in freshwater, made up 99 % or more of the migration at each trapping site, with the remainder being age 2. fish. Age 2. coho smolts migrated earlier on the average than age 1. smolts. Migration of age 2. smolts was complete by the third week of May while the migration of age 1. smolts was still underway (Table 6).

TABLE 6. Percent of age 1. coho smolts by week at Chemainus system trap sites. Remainder of smolts were age 2.

		May				June		Season Totals		
	Week	1	2	3	4	1	2	N	Age 1.	Age 2.
Miller Creek/ Chemainus side channel	1977[a]	97.9	100	-	100	-	-	194	99.0	1.0
Miller Creek	1978	100	99.2	100	100	100	-	678	99.9	0.1
Bonsall Creek	1978	98.1	91.9	99.9	100	100	100	777	99.1	0.9

[a]Includes minnow-trapped fish

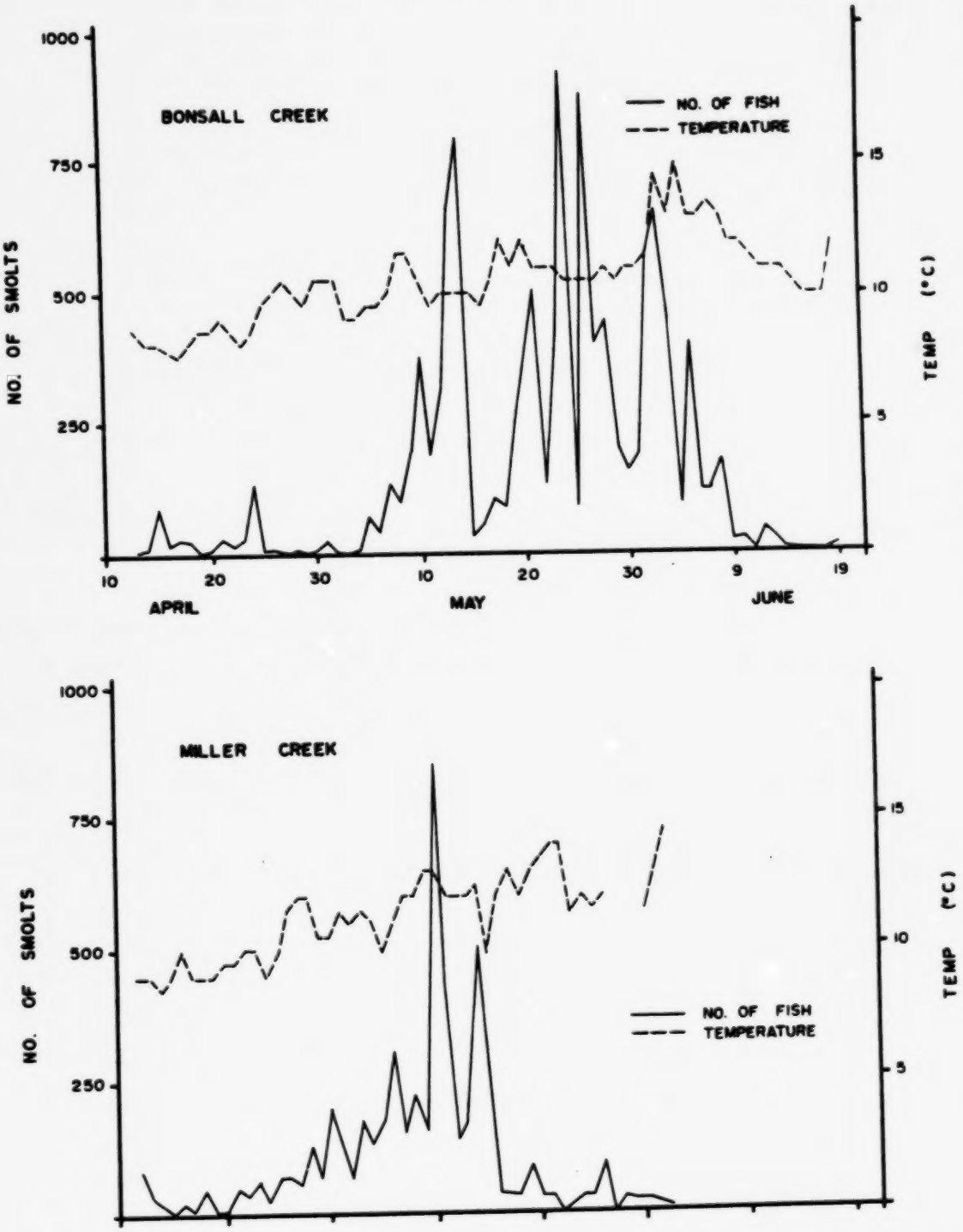

FIGURE 14. Timing of coho smolt migration from Bonsall (above) and Miller (below) creeks in 1978, relative to water temperature.

Bonsall Creek produced significantly larger age 1. smolts (P=<.001) than Miller Creek. Age 1. smolt length in Bonsall Creek averaged 119mm, compared to 109mm in Miller Creek (Table 7). At Bonsall Creek average smolt size varied considerably from week to week and exhibited no clear trend, whereas at Miller Creek the size of age 1. smolts varied little, increasing slightly as the migration progressed (Fig. 15).

The weighted number of tagged coho smolts per kilogram is presented for each year and tagging site in Table 8. Length and weight frequency distributions of coho smolts are given by tagging site and date in Appendices K - P.

TABLE 7. Summary of average unweighted age 1. and age 2. coho smolt fork lengths at the Chemainus system trap sites in 1977 and 1978.

		Age 1.			Age 2.		
		Length (mm)	N	S.D.	Length (mm)	N	S.D.
Miller Creek/ Chemainus side channel[a]	1977	102	192	12.6	109	2	13.4
Miller Creek	1978	109	677	6.0	90	1	-
Bonsall Creek	1978	119	770	13.4	139	7	16.9

[a]Includes minnow-trapped fish

TABLE 8. Weighted numbers of coho smolts per kilogram and pound for each tag code applied at Chemainus system tagging sites.

Tagging Site	Year	Tag Data Codes	No./kg.	No./lb.
Miller Creek/Chemainus side channel[a]	1977	2/3/5	95.9	43.5
Miller Creek	1978	2/20/32	77.5	35.2
Bonsall Creek	1978	2/20/42	58.8	26.7

[a]Includes minnow-trapped fish

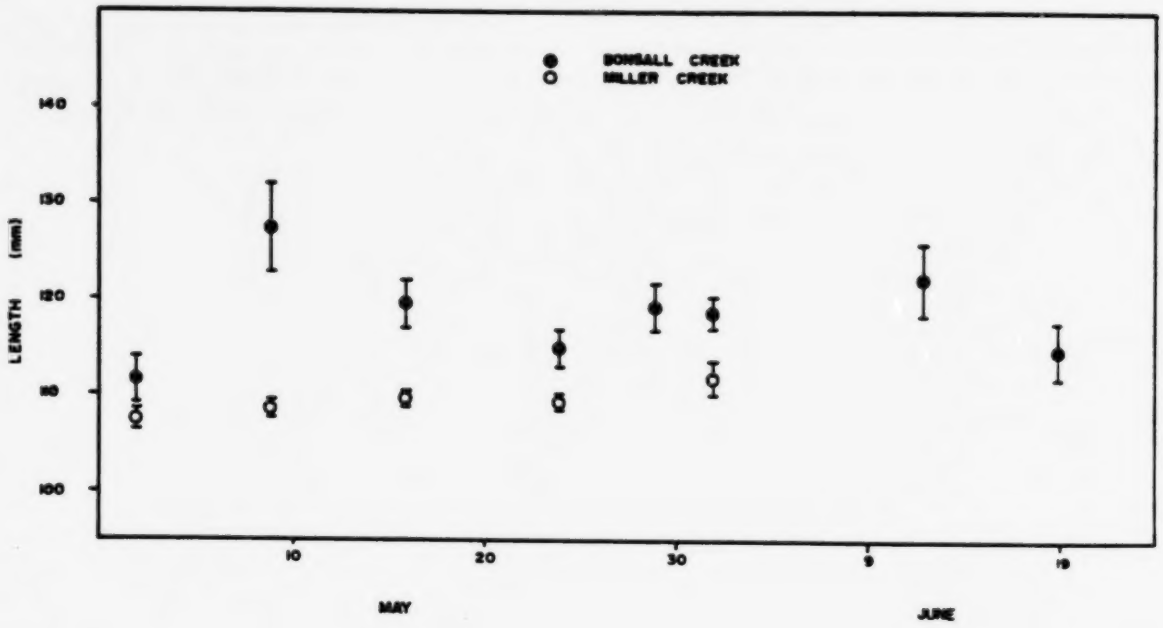

FIGURE 15. Seasonal trends in mean length of Age 1. Coho smolts migrating from Bonsall and Miller creeks during 1978. Vertical bars denote 95 % confidence limits.

Steelhead Smolts

Size measures and scale samples were taken from steelhead smolts caught at the Chemainus River trap in 1978. Scales from a sample of 93 Chemainus steelhead smolts showed the following age breakdown: 9.7 % age 1.; 78.4 % age 2.; 10.8 % age 3., and 1.1 % age 4..

Chemainus River steelhead smolts averaged 153mm in fork length. The average length by age group was as follows:

Age 1	Age 2	Age 3	Age 4
123mm	152mm	173mm	213mm

The weighted number of tagged steelhead smolts per kilogram at Chemainus River was estimated at 27.8 (12.6 fish/lb.). Length and weight frequency distributions of Chemainus River steelhead smolts are presented in Appendices Q and R.

Chinook Fry

All juvenile chinook migrants taken in the Chemainus River trap during 1978 were underyearling fish (Age 0.). Samples taken in June averaged 50mm to 62mm long. The overall average length and weight in these samples amounted to 57mm and 1.9 g respectively (Appendix S).

SUMMARY

1. Coded wire tagging of coho salmon and steelhead trout smolts was carried out at three sites in the Chemainus River area in 1977 and 1978, to provide information on ocean migration and exploitation. In 1977, fence traps were operated in the Chemainus River and Miller Creek during late April and May, and in Bonsall Creek for a five-day period from April 28 to May 2. In 1978, traps were operated at all three sites during the period mid-April to mid-June.

2. Releases of tagged coho smolts from Miller Creek and Chemainus River (code 2/3/5) totalled 5720 in 1977. In 1978, tagged coho smolt releases from Bonsall Creek and Miller Creek were 5249 (code 2/20/32) and 10,720 (code 2/20/42) respectively. A total of 836 tagged steelhead smolts (code 12/16/21) were released from the Chemainus River trap in 1978.

3. Loss of coded wire nose tags within 24 hours of tagging was measured at approximately 1 % for coho and steelhead smolts in 1978, and 1.5 % for coho smolts in 1977.

4. The incidence of naturally missing adipose fins among coho smolts at the three tagging sites was 1 in 1291 fish.

5. Coho smolt outputs from Miller and Bonsall Creeks in 1978 were comparable on an area basis, ie. 31 and 28 fish/100 m^2 respectively, but output per length of stream differed greatly, being 3919/km in Miller Creek compared to 1412/km in Bonsall Creek.

6. Although an interruption in trap operation on the main Chemainus River prevented development of a coho smolt population estimate, the low smolt catch at that site relative to Miller Creek indicates that the latter stream is the principal producer of coho salmon smolts in the Chemainus system.

7. Coho smolt migration in the study streams peaked in May; the migration in Miller Creek averaged two weeks earlier than in Bonsall Creek.

8. Age 1. fish made up 99 % of the coho smolt output from the study streams, with the remainder age 2.. The lengths of age 1. coho smolts from Bonsall and Miller Creeks differed significantly, averaging 119mm and 109mm respectively.

9. Significant numbers of steelhead smolts were captured only in the Chemainus River trap in 1978. Peak migration occurred during May. Analysis of steelhead smolt scales gave the following breakdown of freshwater age: 9.7 % age 1., 78.4 % age 2., 10.8 % age 3., and 1.1 % age 4.. The fork length of Chemainus River steelhead smolts averaged 153mm.

10. In May and June, 1978, a total of 64 adult steelhead trout were captured in an upstream trap at the Chemainus fence and released above the fence.

11. Coho fry were captured at all three trap sites. Chum salmon fry were taken in relatively small numbers at the Bonsall Creek and Chemainus traps. A small number of underyearling chinook were also captured at the latter site, principally during June.

ACKNOWLEDGEMENTS

We wish to thank Bob Armstrong and Doug Brouwer for their assistance throughout the field program and Yvonne Yole who aged all salmonid scales. Special thanks are due to all those people in Duncan who freely gave invaluable help during reconstruction of the Chemainus fence.

For editorial help, thanks to Bob Armstrong and Don Anderson. We particularly thank Brent Lister of D. B. Lister and Associates, biological consultants, who revised and prepared the report for printing.

The assistance of Messrs. Shawn Hay and Gary Horncastle of the B. C. Fish and Wildlife Branch, Nanaimo, in interpreting steelhead smolt scales is also greatly appreciated.

This project was partially funded by Salmonid Enhancement Program.

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APPENDICES

APPENDIX A. DAILY FISH CATCHES AND WATER TEMPERATURES, CHEMAINUS RIVER SIDE CHANNEL, 1977.

Date 1977	Time	Water Temp. (°C)	Coho		Smolt Mortality		Trout	Sculpins	Sticklebacks	Remarks
			Smolts	Fry	Trap	Holding				
May 7	1100	13	-	-	-	-	-	-	-	
8	1100	12	6	-	-	-	-	20	-	
9	1000	12	4	-	-	-	-	20	-	
10	1215	13	-	-	-	-	-	50	-	All fish released due to accidental release of tagged fish upstream of trap.
11	1000	11	1	-	-	-	-	-	-	
12	0818	10	25	-	-	-	NO FURTHER RECORDS FOR THESE "OTHER SPECIES" AVAILABLE			
13	0925	10	20	-	-	-				
14	1035	11	48							
15	1130	10	6	-	-	-				
16	1130	11	5	-	-	-				
17	1120	11	-	-	-	-				
18	0826	11	20	-	-	-				
19	0950	11	8	-	-	-				
20	1115	12	-	-	-	-				
21	1030	12	2	-	-	-				
22	1050	125	-	-	-	-				
23	1145	12	-	-	-	-				
24	0825	12	2	-	-	-				
25	0850	13.5	5	-	-	-				Trap was left dry as level dropped.
26	0945	14	-	-	-	-				
27	0845	12	-	-	-	-				
28	1100	10	-	-	-	-				
29	0800	10	-	-	-	-				
			152							

APPENDIX B. DAILY FISH CATCHES AND WATER TEMPERATURES, MILLER CREEK, 1977.

Date 1977	Time	Water Temp. (°C)	Coho		Smolt Mortality		Trout	Sculpins	Sticklebacks	Remarks
			Smolts	Fry	Trap	Holding				
April 23	0900	13	160	-	-	-	-	8	25	
24	1000	14	140	-	-	-	-	8	15	
25	1600	15	105	-	-	-	-	9	10	
26	0830	13	23	-	-	-	-	12	52	
27	1030	13	35	10	-	1	-	10	20	
28	0900	13	175	4	-	-	-	25	40	
29	0900	13	154	-	1	193	-	3	20	
29	1430	-	240	-	-	-	-	-	-	
30	0830	13.5	130	12	-	-	-	20	80	
May 1	1000	14	110	-	-	-	-	15	50	
2	0930	14.5	135	10	-	1	-	5	50	
3	1000	13	95	-	-	-	-	7	20	
4	1600	11	-	-	-	-	-	-	-	Flow obstructed by beaver
5	1700	12	140	-	-	-	-	-	15	
6	1200	12	120	-	-	-	-	3	20	
7	1200	15	210	-	-	-	-	2	15	
8	1100	13.5	185	-	-	-	-	0	15	
9	0930	13	185	-	-	-	-	1	5	
10	1200	13	140	-	-	-	-	50	-	
11	0945	14	135	-	2	-	-	NO FURTHER		
12	0818	10	175	-	1	-	-	RECORDS KEPT		
13	0915	11	165	-	-	-	-			
14	1033	11	69	-	-	-	-			
15	1115	10	125	-	2	-	-			
16	1125	11	96	-	-	-	-			
17	1115	11	29	-	-	-	-			
18	0820	12	91	-	1	-	-			
19	0935	12	200	-	-	-	-			
20	1112	13	57	-	-	-	-			
21	1015	13	65	-	-	-	-			
22	1045	13.5	30	-	-	-	-			
23	1140	13	4	-	-	-	-			Flow obstructed by beaver
24	0820	13	42	-	1	-	-			
25	0845	13	30	-	-	-	-			
26	0940	13	2	-	-	-	-			
27	0900	13	32	-	1	-	-			
28	1100	11	23	-	-	-	-			
29	0800	11.5	0	-	-	-	-			
30	0800	11.5	0	-	-	-	-			Creek dryed up

APPENDIX C. DAILY FISH CATCHES AND WATER TEMPERATURES, BONSALL CREEK, 1977.

Date	Water Temp. °C	Coho		Chum Fry	Steelhead Smolts
		Smolts	Fry		
1977					
Apr. 28	10	100	0	0	2
Apr. 29	11.5	130	25	10	0
Apr. 30	11	195	5	40	0
May 01	12	60	15	30	0
May 02	11	40	0	25	0
TOTALS		525	45	105	2

APPENDIX D. DAILY FISH CATCHES AND RELATED DATA, CHEMAINUS RIVER, 1978.

Date	Time	Water Temp. °C	Air Temp. °C	Coho Smolts		Chum Fry	Chum Fry	Chinook Fry	Other		Coho Fry	Coho Fry	Coho Adults	Steelhead Adults	Other	Flow cfs	Rain	Water Level cm	Remarks
				Daily Count	Mortality				Species	Number									
Apr 18	1000	6.5	8.5	-		1	7	-		9						110	-		Trap open on west bank
19	1000	6.5	10.5	-		4+	25+			9	+					108	+		
20	1000	6.5	-	-			2++			-	1					-			If it rains washed out, heavy rain last night, fence repaired.
21	0930	6.5	-	-		-	>1			2	-					108	+		
22	1030	6.5	-	-			2+1			2	-	8				75	++		
23	0900	6.5	-	2[a]	-		6++			2	9	17		1				50	Extremely high water, 4 ft. of a farm washed out, gates left open until water level drops.
24	0900	-	-	-			15+			-				1					Trap not fishing - gates open, water flow 750 cfs.
25	0900	-	-	-			10++												Gates still open, vandals threw tangtop platform and holding box in stream - no damage to fence
26	0930	-	-	-			2++					1							Gates still open
27	0830	-	-	-			>1					11						50	Gates still open, water flow 500 cfs.
28	0900	-	-	-			25				1	9				100	+	50	Fence repaired; gates closed
29	1000	-	-	-			25	9			12	2						49	
30	-	-	-	-			80	1				2						48	R. flow int. h-ans
May 1	1130	-	-	-		-	-											48	R. flow int. h-ans, moonset to trap ripped marquisette.
2	1530	11.0	18.0	-		-	-											48	R. flow into h-ans, troughs lowered.
3	0830	9.5	-	-			120	-		12	5			1			+	46	Trap now closed on west bank; now fishing 100%
4	0930	8.0	-	-		-	-			10	-						+	40	Upstream trap installed
5	0900	8.0	10.0	-		2	80	-		82	107						+	42	
6	0930	8.0	16.0	-		2	80	-		65	75			1			+	39	
7	0900	9.5	14.5	-		-	35	-		81	70						+	38	
8	1000	10.0	15.0	19[a]		-	20	-		15	50						+	38	
9	0930	11.0	15.0	-		-	-	-		1	8						+	42	
10	1300	12.5	11.5	-		1	40	-		101	200				1 salmonider			40	
															1 spawned steelhead (dead)				
11	0600	10.0	11.0	-		10	1100	-		66*	110						+	38	4% sterilbead smolts were half eaten; vandals broke into one holding box
12	1100	11.0	13.5	2[a]		4	70	2		110*	210						+	38	4% sterilbead smolts squashed by vandals yesterday
13	-	-	-	-		-	-	-		-	-					-	-	85	Heavy rain last 24 hrs, water over 1' fences on west side; large portions of fence washed out
14	-	-	-	-		-	-	-		-	-					-	-	76	Heavy rain last 24 hrs, water up to 4' fences, more fence washed out.
15	-	-	-	-		-	-	-		-	-					-	-	60	
16	-	-	-	-		-	-	-		-	-					-	-	58	Trap under repair, complete by 1915.
17-18	-	-	-	-		-	>1	-		9	51			1	2		+	38	-
19	-	-	-	-		-	150	-		17	149			-			+	38	
20	-	-	-	-		-	220	-		21	170					73	+	42	
21	-	10.0	-	-		-	220	-		21	170			1		73	+	42	4. sterilbead smolts died in holding pot.
22	0900	9.5	11.0	4[a]		10	250			44	88					55	+	40	
23	1000	9.5	14.0	-		1	550	1		11	93	-				37	+		
24	1100	10.5	11.0	-		-	175	-		20	5	-				13	+		
25	1100	10.5	11.0	-		-	10	1		-	0	-				10	+	43	
26	1030	10.0	-	-		-	10	1		-	1	-		1		2	+	42	
27	1000	10.5	14.0	-		11	650	1		11	40	-		1		2 dead	100	+	42	
28	-	-	-	-		-	2400	+		-	-	-					+		Trash up behind fence, heavy wind and rain, 4 washouts in fence
29	-	-	-	-		-	-	-		-	-	-					-		
30	-	-	-	-		-	-	-		-	-	-					-		Trap repaired
31	1000	11.0	17.0	-		2+	2+			2	8[a]						+	42	Heavy sediment and build up.
Jun 1	1100	14.0	18.0	4[a]		40	150	1		9	84			1	1		+	38	
2	0930	14.0	17.5	-		15	40				11	-		-	-		+	40	
3	0900	14.0	17.0	-		10	60	4			9			1			+	39	
4	1200	10.5	21.0	-		10	20	1			4[a]			1*			+	38	Mink dead
5	1200	10.5	22.0	1[a]		5	9	-		2	8[a]						+	38	
6	1030	17.0	18.5	-		20	15	1			4[a]			1			+	38	Upstream operating - 4 ft. from roof to fence
7	1100	17.0	22.0	-		20	40	1		1	1[a]			-			+	45	
8	1100	16.5	21.0	-		10	10	1		1	0			1			+	50	
9	1100	15.0	17.0	-		25	-	-		2	8						+	51	
10	1200	15.0	20.0	-		12	0	-		1	0[a]						+	50	
11	1100	14.0	16.0	-		30	>1	-			0						+	62	
12	1400	14.0	15.0	-		40	-	-			1+						+	64	4 dead in holding pot
13	1100	12.5	11.0	-		15+	40	10+			-						+	61	
14	1100	12.0	13.0	1		5	+	-			1						+	58	4 [illegible] in holding pot
15	1130	11.0	15.0	-		5	+	-		0	10						+	56	
16	1100	11.0	14.5	-		>1	+	-			-						+		
17	1000	11.0	10.0	-		>1	+	-			-						+		
18	1200	11.0	17.0	-		-	+	-			-						+		
19	1300	14.0	17.5	-		-	-	-			-						+		
20	-	-	14.0	-		-	-	-			-						+		
21	-	-	15.0	-		-	-	-			-						+		
22	-	-	16.0	-		-	-	-			-						+		

[a] Counted during site head count.

APPENDIX E. DAILY FISH CATCHES AND RELATED DATA, MILLER CREEK, 1978.

Date	Time	Water Temp °C	Air Temp °C	Coho Smolts: Daily Count	Coho Smolts: Mortality: Trap	Coho Smolts: Mortality: Holding Pen	Chinook Fry	Steelhead Fry	Trout: Other Species	Trout: Number	Comments	Visibility Inches	Visibility Feet	Temperature	Other	Flow (cfs)	Note	Remarks
Apr 11		Trap installed - beaver dam present again, must be broken every day																
12	0845	9.0	-	78	-	-	-	-	1	-		55	-	-	-	50	N	
13	1100	9.0	-	12	-	-	-	-	-	-		50	-	-	-	10	N	
14	1050	8.5	-	15	-	-	-	-	1	-		21	-	-	1 salamander	100	O	
15	1000	9.0	-	4	-	-	-	-	-	-		6	-	-	-	100	O	
16	1615	10.0	9.0	12	-	-	-	-	-	-		3	-	-	-	100	N	Due to rain last night, sufficient flow into trap. No need to kick out beaver dam.
17	1645	9.0	10.0	5	-	-	-	-	-	1		17	-	-	-	100	O	
18	1000	9.0	8.5	48	-	-	-	-	-	-		12	-	-	-	100	O	
19	1040	9.0	10.5	6	-	-	-	-	1	-		2	-	-	1 mink in trap*	100	O	*Mink trapped.
20	1020	9.5	11.5	9	1	-	-	-	-	-		10	-	-	-	50	O	Sunny till noon.
21	1335	9.5	11.0	50	-	6	-	-	-	14		17	2	-	-	70	O	*An additional 9 steelhead smolts and 18 cutthroat were mixed in with the coho smolts.
22	1100	10.0	-	35	-	-	-	-	-	-		18	-	-	-	100	O	
23	1600	10.0	-	61	-	-	-	-	9	6		15	-	-	1 salamander	0	N	
24	0915	9.0	9.5	24	-	-	-	-	1	2		12	2	-	-	100	N	
25	0830	10.0	11.5	68	-	-	-	-	1	-		18	-	-	1 frog	100	N	Sufficient flow into trap without opening beaver dam.
26	0930	11.5	14.0	71	-	-	-	-	-	1		14	-	-	-	100	N	
27	1100	12.0	13.0	58	1	-	-	-	-	-		11	6	-	-	100	O	
28	1100	12.0	13.0	129	-	-	-	-	1	-		35	2	-	1 frog	100	N	
29	0900	10.5	17.0	61	-	-	-	-	-	-		40	2	-	-	0	N	
30	0945	10.5	11.0	196	-	-	1	-	-	-		30	4	-	-	100	N	Flow was low, had to open up beaver dam.
May 1	1000	11.5	15.0	130	-	-	-	-	1	-		110	-	-	-	0	N	Beaver dam has to be broken every day now.
2	1430	11.0	18.0	65	1	-	-	-	1	-		35	-	-	-	50	N	
3	1030	11.5	16.0	180	-	-	-	-	12	-		50	-	-	-	50	O	
4	1030	11.0	11.0	133	-	-	-	-	-	-		76	-	-	-	0	N	
5	0945	10.0	11.0	180	-	-	-	1	2	-		25	-	-	-	0	N	
6	1030	11.0	14.0	315	-	-	-	-	2	-		22	2	-	-	0	N	Otter seen just above trap site.
7	1000	12.0	15.0	154	2*	-	3	-	2	-		54	4	-	-	10	N	*Trap dryed up.
8	0800	12.0	14.0	225	220*	-	6	-	-	-		10	-	-	-	0	N	*No flow. Overcrowded for amount of holding water. Pen to be opened every 2nd day.
9	1900	13.0	-	158	4	-	-	-	-	-		30	-	-	1 frog	10	N	*40 coho fry. Box was dryed up. Pen to be open 3 times a day.
10	0200			165														
	0900 & 2200	13.0	16.0	582	1	-	3	-	10	4		20	8	-	-	100	O	Late of flow into trap.
11	0430			164														
	2100	12.0	13.0	56	1	-	8	-	8	-		40	4		-	50	O	Trap has to be emptied every evening
12	0300			124														
	2100	12.0	14.0	18	-	-	-	-	2	-		25	6	-	1 frog	100	O	
13	0900	12.0	12.5	180	-	-	-	-	2	-		15	-	-	-	100	O	
14	1400	12.5	17.0	770														
	2300			225	2*	-	-	-	1	-		60	10	-	-	75	O	*Signs of predation.
15	1000	10.0	12.0	900	20*	-	-	-	5	1		20	5	-	-	50	O	Heavy rains. Good flow into trap. Had to block some of it back. Too much turbulence in trap (high water).
16	0830	12.0	14.5	37	-	-	3	-	4	-		15	6	-	-	100	N	
17	1000	13.0	17.0	35	-	-	15	-	-	-		15	4	-	-	25	N	
18	0830	12.0	-	35	-	-	2	-	2	-		14	2	-	-	0	N	
19	0930	13.0	14.0	86	-	-	-	-	3	-		12	5	-	-	0	N	
20	1000	-	-	32	-	-	-	-	2	-		-	-	-	-	0	N	Mink seen in trap.
21	1000	14.0	-	30	-	-	-	-	2	-		18	-	-	-	0	N	
22	0830	14.0	-	0	-	-	25	-	-	-		-	-	-	-	0	N	
23	0800	11.5	11.0	14	-	1	8	-	4	-		12	2	-	-	50	N	No flow into trap. Pen opened. 100 fish released - Upper Chemainus (top caudal clip).
24	0900	12.0	14.5	28	-	-	55	-	-	-		2	4	-	-	0	N	*Additional 5 steelhead in holding with coho smolts.
25	1100	11.5	13.0	29	-	-	40	-	-	-		4	-	-	-	50	O	
26	1000	13.0	-	29	-	-	18	-	-	-		5	1	-	-	100	O	
	1700	-	-	61	-	-	6	-	-	-		4	1	-	-	-	-	
27	0900	-	-	3	4 smolts	-	-	-	-	-		-	-	-	-	50	O	Mink seen in trap.
28	1400	-	-	29	-	-	12	-	-	-		6	5	-	-	50	O	
29	1430	-	-	17	3	-	25	-	-	-		7	2	-	-	15	N	Mink in trap killed 3 smolts.
30	0930	11.5	17.5	16	-	1	15	-	-	-		8	-	-	-	0	N	Mink killed 1 smolt. No water running.
31	-	-	-	-	-	-	-	-	-	-		-	-	-	-	0	-	No fish caught. Did not open up dam last night. Catches too small.
Jun 1	1000	14.5	18.0	9	-	-	25	-	-	-		10	1	-	-	0	N	
2	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Trap finished.
3	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	Trap ripped out. Dam was opened for the last time.
5 = 11.2 (78 trans. w/ [illegible] statures only)																		
Total				5,909	261	6	570	1	94	36		1135	94		1 mink 4 frogs 2 salamanders			

APPENDIX F. DAILY FISH CATCHES AND RELATED DATA, BONSALL CREEK, 1978.

Date	Time	Water Temp. °C	Air Temp. °C	Coho Smolts			Coho Fry	Chum Fry	Trout		Sculpins	Stickleback	Lamprey	Other	% Cloud	Rain	Water Level (cm)	Remarks
				Daily Count	Mortality: Trap	Mortality: Holding Pen			Stlhd	Cuthrt								
Apr 13	1130	8.5	-	6	-	-	-	-	-	-		2	1	-	10	N	55	
14	0915	8.0	-	10	2	-	-	10	-	2 (1 dead)*	135	12	-	-	100	O	56	Mink seen at trap site. *Possibly due to angler release.
15	0900	8.0	-	88	-	-	-	1	-	2	106	7	2	-	100	O	55	
16	0930	-	-	14	-	-	-	2	-	2	95	-	-	-	100	N	58	Rain last night - level up.
17	0845	7.5	11.0	26	-	-	-	4	-	-	90	10	2	-	100	-	56	
18	0915	8.0	8.5	22	-	-	-	45	-	1	81	24	1	-	100	O	56	
19	1130	8.5	10.5	1	-	-	-	50	1	5	95	25	-	-	100	O	54	
20	0940	8.5	11.5	4	1	-	-	70	1	2	171	19	2	-	50	O	-	Sunny all morning.
21	1020	9.0	15.5	29	-	-	-	200	8	3	110	5	2	-	50	O	55	
22	1040	8.5	11.0	14	-	-	-	450	2	3	95	2	-	-	100	O	56	
23	1530	8.0	-	25	-	-	-	350	-	-	60	15	-	-	0	N	57	
24	1545	8.5	16.5	126	-	-	-	75	3	14	35	6	2	-	100	N	56	
25	1030	9.5	15.5	7	-	-	-	-	-	3	20	6	-	-	100	N	55	
26	1000	10.0	15.0	4	-	-	-	-	-	-	120	12	1	-	100	N	54	
27	1015	10.5	12.0	2	-	-	-	4	-	2	147	15	1	-	100	O	54	Local angler told us that at high tide the water was running over our sandbags. This could account for small catches - upstream trap is now in.
28	1010	10.0	13.0	4	-	-	-	150	-	-	120	8	-	-	50	N	-	No fish in upstream trap.
29	0745	9.5	17.0	1	-	1	8	200	-	2	80	20	2	1 flounder 2" dia.	0	N	54	
30	1030	10.5	16.0	4	-	1	-	-	-	-	60	6	-	-	100	N	53	
May 1	0930	10.5	16.5	22	1	1	-	-	-	-	45	-	-	1 flounder	0	N	52	
2	1500	10.5	18.0	0	-	-	-	-	-	-	20	4	-	-	50	N	54	Mink seen at trap site.
3	1100	9.0	-	0	-	-	-	-	-	-	10	-	-	-	50	O	52	
4	1130	9.0	-	4	-	-	-	1	-	-	60	4	-	1 flounder	0	N	50	
5	1300	9.5	17.0	70	-	-	-	6	-	-	45	2	-	-	0	N	50	Built up fence for tidal water back up.
6	1130	9.5	15.5	42	-	-	-	60	-	-	40	4	2	-	0	N	50	
7	1100	10.0	18.0	135	-	-	-	-	4	2	120	6	2	-	0	N	50	
8	1400	11.5	16.5	97	-	2	-	-	-	-	85	-	1	-	0	N	48	
9	1445	11.5	16.0	192	5*	-	-	-	-	3	150	10	2	1 flounder	50	N	50	*Predator marks on all 5 dead.
10	1030	10.5	11.5	381	2	-	3	-	4	12	250	15	10	-	100	N	50	No signs of predation.
11	0800	9.5	11.0	188	4*	1	-	-	-	4	80	8	5	1 crayfish	100	O	50	*All 4 with signs of predation.
12	1700	10.0	13.0	323	4*	1	-	2	-	2	45	4	1	-	100	O	50	*All 4 with signs of predation. Trap to be set.
13	1100	10.0	11.0	661	-	-	8	15	3	4	35	6	-	-	100	O	56	
14	1300	10.0	16.0	800	-	2	6	30	-	11	150	8	11	-	75	N	60	Repaired one hole in the fence.
15	1100	10.0	14.0	10	-	2	25	5	1	-	40	5	-	-	50	O	-	Low catch possibly due to high tides at night. Trap is efficient but the bones become submerged and lids were not fish tight. They are now fixed.
16	1045	9.5	17.0	55	-	-	22	15	-	-	35	-	4	-	0	N	-	Repaired 2 holes under the fence.
17	1030	10.5	14.0	106	-	1	10	-	-	-	60	4	3	-	25	N	-	
18	1400	12.0	18.0	87	-	-	13	-	-	-	50	17	-	-	0	N	55	
19	0930	11.0	17.0	253	1	4*	2	6	-	1	20	4	-	-	0	N	-	*Due to predation.
20	-	12.0	-	350	7*	-	-	-	-	-	21	2	-	-	0	N	52	*Mink in trap.
21	1230	11.0	15.0	510	20*	3	-	-	-	-	24	-	-	-	0	N	50	*Mink in trap. Trap set, mink caught.
22	-	11.0	-	137	-	2	-	-	-	-	27	5	1	-	50	N	-	
23	1500	11.0	19.0	617	-	1	-	-	-	-	35	3	-	-	0	N	52	Released 100 upstream. Clip bottom caudal.
24	1400	10.5	17.0	920	-	-	2	-	-	3	35	3	3	-	0	N	52	
25	1030	10.5	16.0	81	-	2	-	-	-	6	30	7	5	-	50	O	53	Extremely high tides last 2 nights.
26	1600	10.5	-	875	1	1	30	-	-	3	36	7	3	-	100	O	43	
27	1330	10.5	-	400	-	-	-	-	-	-	-	4	1	-	50	O	44	Placed sponge in traps to stop fish from escaping at high tide.
28	1000	11.0	14.0	430	-	-	35	-	-	-	27	13	-	-	50	N	54	
29	1130	10.5	17.0	206	-	-	6	-	-	-	20	8	3	-	0	N	-	
30	1100	11.0	17.0	153	1	3	20	-	-	-	35	12	1	-	0	N	52	2 coho (tagged) in upstream trap. 7 coho fry upstream trap.
31	1100	11.0	17.5	184	-	1	15	2	-	4	54	8	3	-	0	N	50	
Jun 1	1300	11.5	18.0	575	3	-	10	-	-	4	60	-	1	-	0	N	50	100+ coho seen holding just above trap.
2	1300	14.5	20.0	660	-	-	15	-	-	-	120	-	1	-	0	N	50	Release 400 upstream (adipose clip only).
3	1100	13.0	19.0	440	-	-	15	-	-	6	110	2	-	-	0	N	51	
4	1400	15.0	20.0	95	-	-	16	-	-	-	65	7	-	-	0	N	50	
5	1200	13.0	20.0	600	-	1	20	-	-	6	180	8	-	-	0	N	50	
6	0900	13.0	16.0	120	-	-	12	25	1	4	150	6	-	-	25	N	50	
7	1100	13.5	22.2	120	-	1	10	-	-	1	110	20	2	-	0	N	48	
8	1130	13.0	21.0	170	-	-	15	10	-	2	80	10	3	1 flounder	25	N	48	
9	0930	12.0	17.0	22	-	1	10	-	-	-	40	15	1	1 flounder	100	-	48	Trough was plugged with debris. Fish couldn't get through.
10	1130	12.0	17.0	26	1*	1	20	-	-	-	30	5	1	-	100	N	48	*Due to predation (an adipose recap.)
11	1200	11.5	16.0	2	-	1	6	1	-	-	10	-	-	-	100	O	48	
12	1030	11.0	14.0	45	4*	-	15	-	-	3	27	3	-	-	100	O	-	*Due to predation (one bottom caudal clip). Heavy rain this afternoon.
13	0900	11.0	16.0	25	1*	-	45	15	1	-	15	3	1	-	80	O	48	*Due to predation.
14	0930	11.0	12.0	3	-	-	25	-	-	-	10	-	-	-	50	O	49	
15	1030	10.5	16.0	1	-	1	45	8	-	-	15	8	1	-	50	O	49	
16	0930	10.0	12.5	-	-	-	7	-	-	-	5	-	-	1 salamander	90	O	48	
17	0930	10.0	18.0	0	-	-	15	-	-	-	-	1	-	-	0	N	48	
18	1530	10.0	15.0	1	-	-	15	-	-	-	2	-	-	-	0	N	48	
19	1200	11.0	12	-	-	-	-	-	-	-	-	-	-	-	-	N	49	Trap removed

Water temperatures [illegible]

11,233 [illegible] 1 salamander

APPENDIX G. COHO SALMON MINNOW TRAP CATCHES AND WATER TEMPERATURE DATA, CHEMAINUS RIVER STUDY AREA, 1977.

Date 1977	Trestle Slough			Miller Creek Slough			Chemainus River		
	Traps	Catch	Temp. °C	Traps	Catch	Temp. °C	Traps	Catch	Temp. °C
April 26	35	105	10	-	-	-	-	-	-
28	26	70	-	10	25	-	-	-	-
29	18	12	11	16	80	13	-	-	-
30	-	-	-	-	-	-	16	25	11
May 1	4	25	14	10	40	14	-	-	-
11	-	..	-	8	35	14	4	6	11
12	-	-	-	17	225	10	-	-	-
13	5	20	-	12	112	11	-	-	-
14	-	-	-	12	35	11	-	-	-
15	5	25	-	12	63	10	-	-	-
16	..	..	-	12	25	11	-	-	-
17	-	..		12	12	11	-	-	-
18	-	-	-	12	56	12	-	-	-
19	..	-	-	12	76	12	-	-	-
20	.	-	-	12	28	13	-	-	-
21	..	-	-	12	22	13	-	-	-
22	-	-	-	12	10	-	-	-	-
23	-	.	-	12	12	-	-	-	-
24	-	-	-	12	18	-	-	-	-
25	-	..	-	12	8	-	-	-	-
26	-	-	-	12	13	-	-	-	-
27	-	-	-	12	28	-	-	-	-
28	-	-	-	12	9	-	-	-	-
29	-	-	-	12	2	-	-	-	-

APPENDIX H. MARKING AND TAGGING DATA, MILLER CREEK AND CHEMAINUS RIVER SIDE CHANNEL, 1977.

Tagging Location	Tagging Date	Holding Time (days)	Tagging Time		Marked and Tagged	Natural Adipose Missing	Immediate Tagging Mortality	Holding Time for Tag Loss Check (hrs.)	# Tags Lost/ # Checked	Tag Codes Ag/D1/D2
			Start	Finish						
Miller Creek/Chemainus River side channel	May 2	8	1445	1700	1949	6	6	11	6/332	2/3/5
	9	7	1400	1645	1399	-	6	1	0/200	2/3/5
	16	7	1130	1700	1700	2	2	2	3/99	2/3/5
	24	7	0830	1030	757	-	-	1	3/187	2/3/5
TOTAL					5805	8	14			2/3/5

APPENDIX I. MARKING AND TAGGING DATA, CHEMAINUS RIVER STUDY AREA, 1978.

Tagging Location	Tagging Date	Holding Time (days)	Tagging Time Start	Tagging Time Finish	Marked and Tagged	Natural Adipose Missing	Immediate Tagging Mortality	Mortality After Holding	Holding Time (hrs)	# Tags Lost/ # Checked	% Tag Loss	Tag Codes Ag/D1/D2
					COHO SMOLTS							
Miller Creek	Apr 21	10	1330	1430	227	-	-	-	-	no check	-	2/20/32
	May 1	10	1330	1500	814	-	-	-	24	1/138	0.72	2/20/32
	8	7	1000	1120	1211	1	1	-	24	0/136	0	2/20/32
	12	4	1200	1430	1451	1	-	-	-	no check	-	2/20/32
	15	3	1600	1710	1042	-	-	-	24	1/233	0.43	2/20/32
	23	8	1000	1130	322	-	-	-	24	5/222	2.25	2/20/32
	Jun 1	9	1000	1100	230	-	-	-	24	0/47	0	2/20/32
					STEELHEAD SMOLTS							
Miller Creek	May 1	10	1510	1520	12	-	-	-	-	no check	-	12/16/21
	8	7	1130	1210	14	-	-	-	-	"	-	12/16/21
	12	4	1430	1500	23	-	-	-	-	"	-	12/16/21
	15	3	-	-	29	-	-	-	-	"	-	12/16/21
	23	8	-	-	18	-	-	-	-			12/16/21
					COHO SMOLTS							
Bonsall Creek	Apr 21	9	1020	1145	174	-	-	-	-	no check	-	2/20/42
	May 1	10	1515	1615	162	-	-	-	24	1/154	0.64	2/20/42
	8	7	1400	1450	352	-	-	-	24	1/71	1.4	2/20/42
	15	7	1100	1500	2469	1	1	-	24	1/200	0.5	2/20/42
	23	8	1330	1630	2012	2	1	-	24	5/148	3.3	2/20/42
	25	2	0900	1030	827	-	2	-	-	no check	-	2/20/42
	28	3	1000	1230	1773	-	-	1	24	3/168	1.8	2/20/42
	Jun 1	4	1330	1530	1111	2	-	-	24	2/195	1.0	2/20/42
	9	4	1000	1200	1492	-	-	-	24	1/197	0.5	2/20/42
	11	6	1000	1130	390	-	-	-	24	0/90	0	2/20/42
	19	8	1000	1030	77	-	-	-	-	no check	-	2/20/42
					STEELHEAD SMOLTS							
Chemainus River	May 8	7	1130	1210	292	-	-	-	24	0/36	0	12/16/21
	12	4	1400	1500	327	-	-	-	-	no check	-	12/16/21
	15	3	-	-	7	-	-	-	-	no check	-	14/16/21
	23	8	-	-	68	-	-	-	24	1/68	1.47	12/16/21
	Jun 1	9	-	-	57	-	-	-	24	0/57	0	12/16/21
TOTALS BY STREAM												
Miller Creek	Coho Smolts				5297	4	1	0				2/20/32
Bonsall Creek	"				10,839	5	4	1				2/20/42
Miller Creek	Steelhead Smolts				96	0	0	0				12/16/21
Chemainus River	"				751	0	0	0				12/16/21

APPENDIX J. CHEMAINUS RIVER UPSTREAM TRAP CATCHES, 1978.

Date		Time	Steelhead		Coho Fry	Sculpins	Stickle-back	Lamprey	Other
			Adult	Presmolts					
May	05	0900	4	20	-	1	1	1	-
	06	0930	4	30	-	-	-	5	-
	07	0900	3	12	-	-	-	6	1 coho smolt
	08	1000	1	15	-	10	-	48	-
	09	0930	1	30	-	-	-	39	-
	10	1300	6	15	-	-	-	18	6 steelhead smolts
	11	0600	1	6	-	-	-	-	-
	12	1100	2	6	-	-	-	1	-
	13-19[a]	-	-	-	-	-	-	-	-
	20	-	-	60	-	-	-	-	-
	21	-	3	84	-	16	-	1	-
	22	-	4	37	-	6	-	-	-
	23	-	1	10	-	-	-	-	-
	25	1100	2	25	-	15	-	-	-
	26	1030	2	18	-	16	-	-	-
	27	1000	2	130	-	-	-	-	-
	28-30[a]	-	-	-	-	-	-	-	-
	31	1000	3	87	-	-	-	1	-
June	01	1100	-	63	-	15	-	-	1 rainbow trout
	02	0930	2	28	-	15	5	-	1 cutthroat trout
	03	0900	-	87	-	-	10	1	-
	04	1200	1	43	-	48	27	-	-
	05	1200	-	30	380	30	200	-	-
	06	1030	1	30	240	120	235	-	1 cutthroat trout
	07	1100	3	-	5	-	25	-	-
	08	1100	2	-	15	10	10	-	-
	09	1100	3	-	8	-	16	-	-
	10	1200	1	-	-	20	30	-	-
	11	1300	1	5	20	-	30	-	-
	12	1100	-	2	2	-	10	-	-
	13	1100	5	-	-	-	-	-	-
	14	1100	3	-	-	-	-	-	-
	15	1130	-	3	-	-	-	-	-
	16	1100	-	25	5	-	-	-	-
	17	1000	1	-	-	-	-	-	-
	18	1200	-	-	-	-	-	-	-
	19	1300	-	-	-	-	10	-	-
	20	-	1	5	30	20	15	-	-
	21	-	1	2	60	-	-	-	-
	22	-	-	2	50	-	20	-	-
		Total	64	910	807	342	644	121	1 coho smolt, 6 steelhead smolt, 1 rainbow trout, 2 cutthroat trout

[a] Water too high; main trap washed out

APPENDIX K. COHO SMOLT LENGTH DATA, MILLER CREEK/CHEMAINUS RIVER SIDE CHANNEL, 1977.

TAGGING LOT AGE	02/05/77 AGE 1.0	02/05/77 AGE 2.0	09/05/77 AGE 1.0	24/05/77 AGE 1.0	TOTAL TOTAL	TOTAL AGE 1.0	TOTAL AGE 2.0
FREQUENCY INTERVAL	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH
55.0- 54.9	0	0	0	1	1	1	0
55.0- 59.9	0	0	0	0	0	0	0
60.0- 64.9	0	0	0	0	0	0	0
65.0- 69.9	0	0	0	0	0	0	0
70.0- 74.9	1	0	0	3	4	4	0
75.0- 79.9	1	0	0	1	2	2	0
80.0- 84.9	2	0	1	1	4	4	0
85.0- 89.9	5	0	0	4	9	9	0
90.0- 94.9	12	0	5	4	21	21	0
95.0- 99.9	26	1	11	5	43	42	1
100.0-104.9	27	0	21	3	52	51	0
105.0-109.9	8	0	4	4	17	16	0
110.0-114.9	10	0	5	6	22	21	0
115.0-119.9	1	1	1	2	5	4	1
120.0-124.9	0	0	0	6	6	6	0
125.0-129.9	0	0	1	5	6	6	0
130.0-134.9	0	0	0	1	1	1	0
135.0-139.9	1	0	0	1	2	2	0
140.0-144.9	0	0	0	1	1	1	0
145.0-149.9	0	0	0	1	1	1	0
SAMPLE SIZE	94	2	49	49	197	192	2
MEAN	99.62	108.50	101.82	106.04	101.95	101.82	108.50
STD. DEV.	8.85	13.44	7.14	19.92	12.47	12.56	13.44
STD. ERROR	0.91	9.50	1.02	2.85	0.89	0.91	9.50

APPENDIX L. COHO SMOLT WEIGHT DATA, MILLER CREEK/CHEMAINUS RIVER SIDE CHANNEL, 1977.

TAGGING LOT AGE	02/05/77 AGE 1.0	02/05/77 AGE 2.0	09/05/77 AGE 2.0	24/05/77 AGE 1.0	TOTAL TOTAL	TOTAL AGE 1.0	TOTAL AGE 2.0
FREQUENCY INTERVAL	**WEIGHT**	**WEIGHT**	**WEIGHT**	**WEIGHT**	**WEIGHT**	**WEIGHT**	**WEIGHT**
4.0- 5.9	3	0	0	0	3	3	0
6.0- 7.9	13	0	3	0	16	16	0
8.0- 9.9	30	1	12	12	55	54	1
10.0-11.9	30	0	24	38	93	92	0
12.0-13.9	12	0	6	0	20	18	0
14.0-15.9	4	1	3	0	8	7	1
16.0-17.9	1	0	0	0	1	1	0
18.0-19.9	1	0	1	0	2	2	0
SAMPLE SIZE	**94**	**2**	**49**	**50**	**198**	**193**	**2**
MEAN	10.16	12.35	10.82	10.36	10.42	10.38	12.35
STD. DEV.	2.38	4.03	1.94	0.72	1.99	1.97	4.03
STD. ERROR	0.25	2.85	0.28	0.10	0.14	0.14	2.85

APPENDIX M. COHO SMOLT LENGTH DATA, MILLER CREEK, 1978

TAGGING LOT AGE	02 05 78 TOTAL	02 05 78 AGE 1 0	09 05 78 TOTAL	09 05 78 AGE 1 0	09 05 78 AGE 2 0	16 05 78 TOTAL	16/05 78 AGE 1 0
FREQUENCY INTERVAL	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH
90 0 94 9	5	5	2	1	1	0	0
95 0 99 9	10	9	5	5	0	10	10
100 0 104 9	28	28	17	16	0	19	19
105 0 109 9	38	35	48	48	0	67	64
110 0 114 9	36	35	33	30	0	66	64
115 0 119 9	18	17	18	15	0	28	28
120 0 124 9	1	1	3	3	0	9	7
125.0 129 9	1	0	0	0	0	0	0
SAMPLE SIZE	137	130	126	118	1	199	192
MEAN	107 63	107 50	108 70	108 65	90.00	109 64	109.52
STD. DEV.	6 60	6 42	5 89	5 63	0 0	5.55	5.49
STD. ERROR	0 56	0 56	0 52	0 52	0.0	0.39	0.40

TAGGING LOT AGE	24/05/78 TOTAL	24/05/78 AGE 1.0	02/06/78 TOTAL	02/06/78 AGE 1.0	TOTAL TOTAL	TOTAL AGE 1.0	TOTAL AGE 2.0
FREQUENCY INTERVAL	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH
90 0 94 9	1	1	1	1	9	8	1
95 0 99 9	11	9	0	0	36	33	0
100 0 104 9	26	21	4	4	94	88	0
105 0 109 9	76	70	12	11	241	228	0
110 0 114 9	67	53	17	16	219	198	0
115 0 119 9	31	29	7	7	102	96	0
120 0 124 9	8	8	5	5	26	24	0
125 0 129 9	1	1	1	1	3	2	0
SAMPLE SIZE	221	192	47	45	730	677	1
MEAN	109 26	109 34	111 72	111 80	109 12	109 08	90 00
STD DEV	5 77	5 85	6 35	6 47	6 00	5 95	0 0
STD ERROR	0 39	0 42	0 93	0 96	0 22	0 23	0 0

APPENDIX N. COHO SMOLT WEIGHT DATA, MILLER CREEK, 1978

TAGGING LOT AGE	02 05 78 TOTAL	02 05 78 AGE 1 0	09 05 78 TOTAL	09 05 78 AGE 1 0	09 05 78 AGE 2 0	16 05 78 TOTAL	16 05 78 AGE 1 0
FREQUENCY INTERVAL	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT
6.0 7.9	4	4	2	1	1	0	0
8.0 9.9	15	14	6	5	0	2	2
10.0 11.9	43	41	22	22	0	50	49
12.0 13.9	46	45	65	63	0	79	77
14.0 15.9	23	21	23	19	0	56	53
16.0 17.9	5	5	7	7	0	11	10
18.0 19.9	1	0	1	1	0	1	1
SAMPLE SIZE	137	130	126	118	1	199	192
MEAN	12.26	12.21	12.91	12.90	6.60	13.20	13.17
STD. DEV.	2.24	2.19	1.99	1.90	0.0	1.82	1.81
STD. ERROR	0.19	0.19	0.18	0.18	0.0	0.13	0.13

TAGGING LOT AGE	24/05/78 TOTAL	24/05/78 AGE 1 0	02/06/78 TOTAL	02/06/78 AGE 1 0	TOTAL TOTAL	TOTAL AGE 1.0	TOTAL AGE 2.0
FREQUENCY INTERVAL	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT
6.0 7.9	0	0	1	1	7	6	1
8.0 9.9	15	12	1	1	39	34	0
10.0 11.9	52	45	11	10	178	167	0
12.0 13.9	96	84	20	19	306	288	0
14.0 15.9	37	31	8	8	147	132	0
16.0 17.9	15	14	6	6	44	42	0
18.0 19.9	6	6	0	0	9	8	0
SAMPLE SIZE	221	192	47	45	730	677	1
MEAN	12.97	13.01	13.06	13.11	12.90	12.89	6.60
STD. DEV	2.10	2.14	2.11	2.14	2.06	2.05	0.0
STD. ERROR	0.14	0.15	0.31	0.32	0.08	0.08	0.0

APPENDIX O. COHO SMOLT LENGTH DATA, BONSALL CREEK, 1978.

TAGGING LOT AGE	02 05 78 TOTAL	02 05 78 AGE 1 0	02 05 78 AGE 2 0	09 05 78 TOTAL	09 05 78 AGE 1 0	09 05 78 AGE 2 0
FREQUENCY INTERVAL	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH
90 0 94 9	2	2	0	0	0	0
95 0 99 9	0	0	0	0	0	0
100 0 104 9	10	9	0	2	2	0
105 0 109 9	13	11	0	6	5	0
110 0 114 9	13	13	0	6	5	0
115 0 119 9	15	11	0	5	3	0
120 0 124 9	2	2	0	11	10	0
125 0 129 9	0	0	0	14	10	3
130 0 134 9	2	2	0	11	8	1
135 0 139 9	2	2	0	8	7	1
140 0 144 9	1	1	0	0	0	0
145 0 149 9	0	0	0	4	4	0
150 0 154 9	0	0	0	1	1	0
155 0 159 9	1	0	1	1	1	0
160 0 164 9	0	0	0	0	0	0
165 0 169 9	0	0	0	0	0	0
170 0 174 9	0	0	0	0	0	0
175 0 179 9	0	0	0	0	0	0
180 0 184 9	0	0	0	0	0	0
185 0 189 9	0	0	0	0	0	0
190 0 194 9	0	0	0	0	0	0
195 0 199 9	0	0	0	0	0	0
200 0 204 9	0	0	0	0	0	0
205 0 209 9	0	0	0	0	0	0
210 0 214 9	0	0	0	0	0	0
215 0 219 9	0	0	0	0	0	0
220 0 224 9	0	0	0	0	0	0
SAMPLE SIZE	61	53	1	70	57	5
MEAN	112 38	111 68	155 00	126 93	127 47	130 20
STD DEV	11 22	10 24	0 0	16 49	17 77	5 12
STD ERROR	1 44	1 41	0 0	1 97	2 35	2 29

APPENDIX O. (CONTINUED).

TAGGING LOT AGE	16/05/78 TOTAL	16/05/78 AGE 1.0	16/05/78 AGE 2.0	24/05/78 TOTAL	24/05/78 AGE 1.0	29/05/78 TOTAL	29/05/78 AGE 1.0
FREQUENCY INTERVAL	**LENGTH**	**LENGTH**	**LENGTH**	**LENGTH**	**LENGTH**	**LENGTH**	**LENGTH**
85.0 89.9	1	1	0	0	0	0	0
90.0 94.9	0	0	0	2	2	1	1
95.0 99.9	3	3	0	5	4	5	3
100.0-104.9	4	4	0	20	15	11	9
105.0-109.9	14	13	0	17	14	14	12
110.0-114.9	13	12	0	30	26	25	21
115.0-119.9	19	17	0	19	17	33	26
120.0-124.9	13	13	0	30	26	35	25
125.0-129.9	10	10	0	15	10	25	19
130.0-134.9	9	9	0	5	3	7	6
135.0-139.9	6	6	0	2	2	4	4
140.0 144.9	4	4	0	0	0	3	2
145.0-149.9	3	3	0	0	0	3	2
150.0-154.9	0	0	0	2	2	0	0
155.0-159.9	0	0	0	1	0	1	1
160.0-164.9	0	0	0	0	0	0	0
165.0-169.9	0	0	0	0	0	0	0
170.0 174.9	1	0	1	0	0	0	0
175.0 179.9	0	0	0	0	0	0	0
180.0 184.9	0	0	0	0	0	0	0
185.0 189.9	0	0	0	0	0	0	0
190.0-194.9	0	0	0	0	0	0	0
195.0 199.9	0	0	0	0	0	0	0
200.0 204.9	0	0	0	0	0	0	0
205.0 209.9	0	0	0	0	0	0	0
210.0 214.9	0	0	0	0	0	0	0
215.0 219.9	0	0	0	0	0	0	0
220.0 224.9	0	0	0	0	0	0	0
225.0 229.9	0	0	0	0	0	1	1
SAMPLE SIZE	100	95	1	148	121	168	132
MEAN	119.96	119.68	170.00	115.36	115.08	119.32	119.37
STD. DEV.	13.35	12.58	0.0	10.99	10.55	13.62	14.37
STD. ERROR	1.34	1.29	0.0	0.90	0.96	1.05	1.25

APPENDIX O. (CONTINUED).

TAGGING LOT AGE	02/06/78 TOTAL	02/06/78 AGE 1.0	12/06/78 TOTAL	12/06/78 AGE 1.0	19/06/78 TOTAL	19/06/78 AGE 1.0
FREQUENCY INTERVAL	**LENGTH**	**LENGTH**	**LENGTH**	**LENGTH**	**LENGTH**	**LENGTH**
85.0- 89.9	0	0	0	0	3	1
90.0- 94.9	1	1	2	2	3	3
95.0- 99.9	3	3	3	2	8	7
100.0-104.9	16	15	3	3	6	6
105.0-109.9	15	14	5	5	7	7
110.0-114.9	22	22	14	9	11	11
115.0-119.9	33	29	15	11	12	9
120.0-124.9	40	37	11	9	12	10
125.0-129.9	33	30	11	6	7	6
130.0-134.9	15	12	11	10	8	8
135.0-139.9	5	5	2	1	3	2
140.0-144.9	2	1	2	2	2	2
145.0-149.9	3	2	3	2	0	0
150.0-154.9	0	0	2	1	0	0
155.0-159.9	2	2	2	2	0	0
160.0-164.9	0	0	1	1	0	0
165.0-169.9	0	0	1	1	0	0
SAMPLE SIZE	190	173	88	67	82	72
MEAN	119.17	118.78	122.41	122.36	114.70	114.92
STD. DEV.	10.93	10.83	15.14	15.88	13.42	12.91
STD. ERROR	0.79	0.82	1.61	1.94	1.48	1.52

APPENDIX O. (CONTINUED).

TAGGING LOT AGE	TOTAL TOTAL	TOTAL AGE 1.0	TOTAL AGE 2.0
FREQUENCY INTERVAL	LENGTH	LENGTH	LENGTH
85.0 89.9	4	2	0
90.0 94.9	11	11	0
95.0 99.9	27	22	0
100.0 104.9	72	63	0
105.0 109.9	91	81	0
110.0 114.9	134	119	0
115.0 119.9	151	123	0
120.0 124.9	154	132	0
125.0 129.9	115	91	3
130.0 134.9	68	58	1
135.0 139.9	32	29	1
140.0 144.9	14	12	0
145.0 149.9	16	13	0
150.0 154.9	5	4	0
155.0 159.9	8	6	1
160.0 164.9	1	1	0
165.0 169.9	1	1	0
170.0 174.9	1	0	1
175.0 179.9	0	0	0
180.0 184.9	0	0	0
185.0 189.9	0	0	0
190.0 194.9	0	0	0
195.0 199.9	0	0	0
200.0 204.9	0	0	0
205.0 209.9	0	0	0
210.0 214.9	0	0	0
215.0 219.9	0	0	0
220.0 224.9	1	1	0
225.0 229.9	1	1	0
SAMPLE SIZE	807	[illegible]	7
MEAN	116.72	119.[illegible]	139.43
STD DEV	[illegible]	[illegible]	16.87
STD ERROR	[illegible]	[illegible]	6.[illegible]

APPENDIX P. COHO SMOLT WEIGHT DATA, BONSALL CREEK, 1978.

TAGGING LOT AGE	02/05/78 TOTAL	02/05/78 AGE 1.0	02/05/78 AGE 2.0	09/05/78 TOTAL	09/05/78 AGE 1.0	09/05/78 AGE 2.0
FREQUENCY INTERVAL	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT
8.0- 9.9	3	3	0	0	0	0
10.0-11.9	16	14	0	4	3	0
12.0-13.9	11	10	0	4	4	0
14.0-15.9	16	13	0	6	6	0
16.0-17.9	7	6	0	6	6	0
18.0-19.9	3	3	0	9	8	1
20.0-21.9	0	0	0	9	3	2
22.0-23.9	0	2	0	5	7	1
24.0-25.9	2	0	0	10	9	1
26.0-27.9	0	0	0	11	3	0
28.0-29.9	0	1	0	4	2	0
30.0-31.9	1	1	0	2	2	0
32.0-33.9	1	0	0	2	2	0
34.0-35.9	0	0	0	2	0	0
36.0-37.9	0	0	0	0	1	0
38.0-39.9	0	0	0	1	0	0
40.0-41.9	1		1	1	1	0
SAMPLE SIZE	61	53	1	70	57	5
MEAN	14.93	14.58	41.30	21.24	21.38	23.52
STD DEV	5.69	4.79	0.0	6.16	6.53	2.52
STD ERROR	0.73	0.66	0.0	0.74	0.87	1.13

APPENDIX P. (CONTINUED).

TAGGING LOT AGE	16/05/78 TOTAL	16/05/78 AGE 1.0	16/05/78 AGE 2.0	24/05/78 TOTAL	24/05/78 AGE 1.0	29/05/78 TOTAL	29/05/78 AGE 1.0
FREQUENCY INTERVAL	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT
6.0- 7.9	1	1	0	1	1	2	2
8.0- 9.9	4	4	0	6	4	8	5
10.0-11.9	9	8	0	22	18	15	13
12.0-13.9	19	19	0	24	19	30	24
14.0-15.9	8	7	0	31	28	28	21
16.0-17.9	17	15	0	23	18	40	32
18.0-19.9	10	10	0	20	19	21	15
20.0-21.9	5	5	0	12	8	9	7
22.0-23.9	12	12	0	5	3	4	4
24.0-25.9	2	2	0	1	1	4	3
26.0-27.9	5	5	0	0	0	0	0
28.0-29.9	1	1	0	0	0	3	3
30.0-31.9	2	2	0	0	0	3	2
32.0-33.9	2	2	0	0	0	0	0
34.0-35.9	1	1	0	0	0	0	0
36.0-37.9	1	1	0	0	0	0	0
38.0-39.9	0	0	0	1	0	0	0
40.0-41.9	0	0	0	2	2	0	0
42.0-43.9	0	0	0	0	0	0	0
44.0-45.9	1	0	1	0	0	0	0
SAMPLE SIZE	100	95	1	148	121	167	131
MEAN	18.20	18.06	44.90	15.90	15.75	16.12	16.10
STD. DEV.	6.77	6.32	0.0	5.04	4.76	4.51	4.58
STD. ERROR	0.68	0.65	0.0	0.41	0.43	0.35	0.40

APPENDIX P. (CONTINUED).

TAGGING LOT AGE	02/06/78 TOTAL	02/06/78 AGE 1.0	12/06/78 TOTAL	12/06/78 AGE 1.0	19/06/78 TOTAL	19/06/78 AGE 1.0
FREQUENCY INTERVAL	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT	WEIGHT
4.0- 5.9	0	0	0	0	2	1
6.0- 7.9	1	1	1	1	7	5
8.0- 9.9	5	5	6	5	8	8
10.0-11.9	19	18	6	5	13	12
12.0-13.9	24	23	16	11	11	10
14.0-15.9	16	16	13	10	10	9
16.0-17.9	44	38	11	9	12	12
18.0-19.9	37	36	13	9	9	6
20.0-21.9	26	23	8	6	3	3
22.0-23.9	10	7	4	4	4	3
24.0-25.9	0	0	1	1	2	2
26.0-27.9	2	2	3	2	0	0
28.0-29.9	1	1	0	0	1	1
30.0-31.9	1	0	2	1	0	0
32.0-33.9	3	2	2	1	0	0
34.0-35.9	1	1	1	1	0	0
36.0-37.9	0	0	0	0	0	0
38.0-39.9	1	1	0	0	0	0
40.0-41.9	1	1	0	0	0	0
42.0-43.9	0	0	0	0	0	0
44.0-45.9	0	0	0	0	0	0
46.0-47.9	0	0	1	1	0	0
SAMPLE SIZE	192	175	88	67	82	72
MEAN	17.43	17.19	17.37	17.29	14.33	14.37
STD. DEV.	5.19	5.10	6.67	6.81	5.04	4.94
STD. ERROR	0.37	0.39	0.71	0.83	0.56	0.58

APPENDIX P. (CONTINUED)

TAGGING LOT AGE FREQUENCY INTERVAL	TOTAL TOTAL WEIGHT	TOTAL AGE 1.0 WEIGHT	TOTAL AGE 2.0 WEIGHT
4.0- 5.9	2	1	0
6.0- 7.9	13	11	0
8.0- 9.9	40	34	0
10.0-11.9	104	91	0
12.0-13.9	139	120	0
14.0-15.9	128	110	0
16.0-17.9	163	136	0
18.0-19.9	122	106	0
20.0-21.9	68	55	1
22.0-23.9	49	40	2
24.0-25.9	23	20	1
26.0-27.9	14	12	1
28.0-29.9	8	8	0
30.0-31.9	11	8	0
32.0-33.9	10	8	0
34.0-35.9	3	3	0
36.0-37.9	2	2	0
38.0-39.9	2	1	0
40.0-41.9	5	4	1
42.0-43.9	0	0	0
44.0-45.9	1	0	1
46.0-47.9	1	1	0
SAMPLE SIZE	908	771	7
MEAN	16.86	16.76	29.11
STD. DEV.	5.74	5.63	9.83
STD. ERROR	0.19	0.20	3.71

APPENDIX Q. STEELHEAD SMOLT LENGTH DATA, CHEMAINUS RIVER, 1978. TOTAL SAMPLE INCLUDES FISH WHICH COULD NOT BE AGED.

Length Frequency Interval	24/05/78 Total	24/05/78 Age 1.0	24/05/78 Age 2.0	24/05/78 Age 3.0	24/05/78 Age 4.0	02/06/78 Total	02/06/78 Age 1.0	02/06/78 Age 2.0	02/06/78 Age 3.0
80.0 - 84.9	1	1	0	0	0	0	0	0	0
85.0 - 89.9	1	1	0	0	0	0	0	0	0
90.0 - 94.9	1	1	0	0	0	0	0	0	0
95.0 - 99.9	0	0	0	0	0	0	0	0	0
100.0 - 104.9	1	0	0	0	0	0	0	0	0
105.0 - 109.9	0	0	0	0	0	0	0	0	0
110.0 - 114.9	1	0	0	0	0	0	0	0	0
115.0 - 119.9	1	1	0	0	0	1	0	0	0
120.0 - 124.9	1	0	1	0	0	4	1	1	0
125.0 - 129.9	4	0	3	0	0	5	1	3	0
130.0 - 134.9	4	0	2	0	0	1	0	0	0
135.0 - 139.9	5	0	1	0	0	4	0	3	0
140.0 - 144.9	3	0	1	0	0	5	0	5	0
145.0 - 149.9	5	0	2	0	0	2	1	0	0
150.0 - 154.9	10	0	4	0	0	6	2	4	0
155.0 - 159.9	5	0	3	0	0	10	0	6	0
160.0 - 164.9	9	0	4	0	0	6	0	3	1
165.0 - 169.9	4	0	1	1	0	6	0	2	2
170.0 - 174.9	2	0	0	0	0	4	0	2	0
175.0 - 179.9	3	0	0	0	0	1	0	0	1
180.0 - 184.9	2	0	0	1	0	1	0	0	0
185.0 - 189.9	1	0	0	0	0	0	0	0	0
190.0 - 194.9	1	0	1	0	0	0	0	0	0
195.0 - 199.9	0	0	0	0	0	0	0	0	0
200.0 - 204.9	0	0	0	0	0	0	0	0	0
205.0 - 209.9	0	0	0	0	0	0	0	0	0
210.0 - 214.9	1	0	0	0	1	0	0	0	0
215.0 - 219.9	0	0	0	0	0	0	0	0	0
220.0 - 224.9	0	0	0	0	0	1	0	0	0
225.0 - 229.9	0	0	0	0	0	0	0	0	0
230.0 - 234.9	1	0	0	0	0	0	0	0	0
Sample Size	67	4	23	2	1	57	5	29	4
Mean	150.58	94.75	149.22	173.00	213.00	156.61	146.00	154.76	172.50
Std. Dev.	25.43	13.66	15.60	7.00	0.0	18.13	12.15	13.10	5.50
Std. Error	3.11	6.83	3.25	4.95	0.0	2.40	2.99	2.43	2.75

APPENDIX Q. (CONTINUED).

Length Frequency Interval	Overall Total	Total Age 1.0	Total Age 2.0	Total Age 3.0	Total Age 4.0
80.0 - 84.9	1	1	0	0	0
85.0 - 89.9	1	1	0	0	0
90.0 - 94.9	1	1	0	0	0
95.0 - 99.9	0	0	0	0	0
100.0 - 104.9	1	0	0	0	0
105.0 - 109.9	0	0	0	0	0
110.0 - 114.9	1		0	0	0
115.0 - 119.9	1	1	0	0	0
120.0 - 124.9	2	0	1	0	0
125.0 - 129.9	8	1	4	0	0
130.0 - 134.9	9	1	5	0	0
135.0 139.9	6	0	1	0	0
140.0 - 144.9	7	0	4	0	0
145.0 - 149.9	10	0	7	0	0
150.0 - 154.9	12	1	4	0	0
155.0 - 159.9	11	2	7	0	0
160.0 - 164.9	19	0	10	0	0
165.0 - 169.9	10	0	4	2	0
170.0 - 174.9	8	0	2	2	0
175.0 - 179.9	7	0	2	0	0
180.0 - 184.9	3	0	0	2	0
185.0 - 189.9	2	0	0	0	0
190.0 - 194.9	1	0	1	0	0
195.0 - 199.9	0	0	0	0	0
200.0 - 204.9	0	0	0	0	0
205.0 - 209.9	0	0	0	0	0
210.0 - 214.9	1	0	0	0	0
215.0 - 219.9	0	0	0	0	1
220.0 - 224.9	1	0	0	0	0
225.0 - 229.9	0	0	0	0	0
230.0 - 234.9	0	0	0	0	0
Sample Size	124	9	52	6	1
Mean	153.35	123.22	152.31	172.67	213.00
Std. Dev.	22.49	28.52	14.66	6.62	0.0
Std. Error	2.02	9.51	2.03	2.70	0.0

APPENDIX R. STEELHEAD SMOLT WEIGHT DATA, CHEMAINUS RIVER, 1978.

APPENDIX R. STEELHEAD SMOLT WEIGHT DATA, CHEMAINUS RIVER, 19[illegible]. [illegible]
NOT BE AGED.

Weight Frequency Interval	09/05/78 Total	09/05/78 Age 2.0	09/05/70 Age 3.0	24/05/78 Total	24/05/78 Age 1.0	24/05/78 Age 2.0	24/05/78 Age 3.0	24/05/78 Age 4.0
6.0 - 9.9	0	0	0	3	3	0	0	0
10.0 - 13.9	0	0	0	2	0	0	0	0
14.0 - 17.9	0	0	0	1	1	0	0	0
18.0 - 21.9	2	2	2	7	0	5	0	0
22.0 - 25.9	6	2	1	11	0	3	0	0
26.0 - 29.9	4	4	0	4	0	2	0	0
30.0 - 33.9	6	3	0	14	0	7	0	0
34.0 - 37.9	7	4	0	7	0	2	1	0
38.0 - 41.9	2	1	1	4	0	3	0	0
42.0 - 45.9	3	2	1	4	0	0	0	0
46.0 - 49.9	4	3	0	2	0	0	1	0
50.0 - 53.9	0	0	0	1	0	0	0	0
54.0 - 57.9	0	0	0	3	0	0	0	0
58.0 - 61.9	1	0	1	1	0	1	0	0
62.0 - 65.9	1	0	0	1	0	0	0	0
66.0 - 69.9	0	0	0	0	0	0	0	0
70.0 - 73.9	0	0	0	0	0	0	0	1
90.0 - 93.9	0	0	0	0	0	0	0	0
94.0 - 97.9	0	0	0	1	0	0	0	0
98.0 - 101.9	0	0	0	0	0	0	0	0
102.0 - 105.9	0	0	0	0	0	0	0	0
106.0 - 109.9	0	0	0	0	0	0	0	0
110.0 - 113.9	0	0	0	0	0	0	0	0
114.0 - 115.9	0	0	0	1	0	0	0	0
Sample Size	36	21	4	67	4	23	2	1
Mean	34.85	33.40	43.48	34.22	9.30	30.63	46.05	95.60
Std. Dev.	10.25	8.35	13.37	18.70	4.57	9.35	4.85	0.0
Std. Error	1.71	1.82	6.69	2.29	2.29	1.95	3.43	0.0

APPENDIX R. (CONTINUED).

Weight Frequency Interval	02/06/78 Total	02/06/78 Age 1.0	02/06/78 Age 2.0	02/06/78 Age 3.0	Overall Total	Total Age 1.0	Total Age 2.0	Total Age 3.0	Total Age 4.0
6.0 - 9.9	0	0	0	0	3	3	0	0	0
10.0 - 13.9	0	0	0	0	2	0	0	0	0
14.0 - 17.9	4	0	1	0	5	1	1	0	0
18.0 - 21.9	7	1	4	0	16	1	11	0	0
22.0 - 25.9	6	1	4	0	23	1	9	1	0
26.0 - 29.9	4	1	2	0	12	1	8	0	0
30.0 - 33.9	12	2	6	0	32	2	16	0	0
34.0 - 37.9	8	0	6	2	22	0	12	2	0
38.0 - 41.9	9	0	3	0	15	0	7	2	0
42.0 - 45.9	4	0	3	1	11	0	5	2	0
46.0 - 49.9	1	0	0	1	7	0	3	1	0
50.0 - 53.9	1	0	0	0	2	0	0	1	0
54.0 - 57.9	0	0	0	0	3	0	0	0	0
58.0 - 61.9	0	0	0	0	1	0	0	0	0
62.0 - 65.9	0	0	0	0	2	0	1	1	0
66.0 - 69.9	0	0	0	0	0	0	0	0	0
70.0 - 73.9	0	0	0	0	0	0	0	0	0
90.0 - 93.9	0	0	0	0	0	0	0	0	0
94.0 - 97.9	0	0	0	0	1	0	0	0	0
98.0 - 101.9	1	0	0	0	1	0	0	0	0
102.0 - 105.9	1	0	0	0	0	0	0	0	0
106.0 - 109.9	0	0	0	0	0	0	0	0	0
110.0 - 113.9	0	0	0	0	0	0	0	0	0
114.0 - 115.9	0	0	0	0	1	0	0	0	0
Sample Size	57	5	29	4	160	9	73	10	1
Mean	32.64	27.12	30.91	41.55	33.80	19.20	31.54	43.22	95.60
Std. Dev.	12.64	5.32	7.71	4.06	15.02	10.17	8.58	9.75	0.0
Std. Error	1.67	2.38	1.43	2.03	1.19	3.39	1.00	3.09	0.0

POOR

QUALITY

ORIGINAL